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HiRUN N300 VECTOR INVERTER

INSTRUCTION MANUAL

HYUNDAI
HEAVY INDUSTRIES CO., LTD.

SAFETY

For the Best Results with N300 Series inverter, read this manual and all of the warning sign attached to the inverter carefully before installing and operating it, and follow the instructions exactly. Keep this manual handy for your quick reference.

Definitions and Symbols

A safety instruction (message) is given with a hazard alert symbol and a signal word, **WARNING** or **CAUTION**. Each signal word has the following meaning throughout this manual.

This symbol means hazardous high voltage. It used to call your attention to items or operations that could be dangerous to you or other persons operating this equipment.
Read these message and follow these instructions carefully.

This is the "Safety Alert Symbol" This symbol is used to call your attention to items or operations that could be dangerous to you or other persons operating this equipment.
Read these messages and follow these instructions carefully.

WARNING Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

CAUTION Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage of product.
The matters described under ⚠ **CAUTION** may, if not avoided, lead to serious results depending on the situation. Important matters are described in **CAUTION** (as well as **WARNING**), so be sure to observe them.

NOTE Notes indicate an area or subject of special merit, emphasizing either the product's capabilities or common errors in operation or maintenance.

HAZARDOUS HIGH VOLTAGE

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there might be exposed components with cases or protrusions at or above line potential. Extreme care should be taken to product against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on an electronic controller or rotating electrical equipment.

PRECAUTION

⚠ **WARNING :** This is equipment should be installed, adjusted and serviced by qualified electrical maintenance personal familiar with the construction and operation of the equipment and the hazards involved. Failure to observe this precaution could results in bodily injury.

⚠ **WARNING :**The user is responsible for ensuring that all driven machinery, drive train mechanism not supplied by HYUNDAI and process line material are capable of safe operation at an applied frequency of 150% of the maximum selected frequency range to the AC motor. Failure to do so can result in destruction of equipment and injury to personnel should a single point failure occur.

⚠ **WARNING :** For protection, install an earth leakage breaker with a high frequency circuit capable of large currents to avoid an unnecessary operation. The ground fault protection circuit is not designed to protect personal injury.

⚠ **WARNING :** Hazard of electrical shock. Disconnect incoming power before working on this control.

⚠ **WARNING :** Separate motor overcurrent, overload and overheating protection is required to be provided in accordance with the safety codes required by jurisdictional authorities.

⚠ **CAUTION :** These instructions should be read and clearly understood before working on N300 series equipment.

⚠ **CAUTION :** Proper grounds, disconnecting devices and other safety devices and their location are the responsibility of the user and are not provided by HYUNDAI.

⚠ **CAUTION :** Be sure to connect a motor thermal switch or overload devices to the N300 series controller to assure that inverter will shut down in the event of an overload or an overheated motor.

⚠ **CAUTION :** Dangerous voltage exists until charge lamp is off.

⚠ **CAUTION :** Rotating shafts and above ground electrical potentials can be hazardous. Therefore, it is strongly recommended that all electrical work conform to the National Electrical Codes and local regulations. Only qualified personnel should perform installation, alignment and maintenance. Factory recommended test procedures, included in the instruction manual, should be followed. Always disconnect electrical power before working on the unit.

NOTE : POLLUTION DEGREE2

The inverter must be used environment of the degree 2.

Typical constructions that reduce the possibility of conductive pollution are,

1) The use of an unventilated enclosure
2) The use of a filtered ventilated enclosure when the ventilation is fan forced that is, ventilation is accomplished by one more blowers within the enclosure that provide a positive intake and exhaust.

Cautions for EMC (Electromagnetic Compatibility)

To safety the EMC directive and to comply with standard, follows the checklist below.

WARNING

This equipment should be installed, adjusted, and serviced by qualified personal familiar with construction and operation of the equipment and the hazards involved. Failure to observe this precaution could result in bodily injury.

1. The power supply to N300 inverter must meet these specifications
   a. Voltage fluctuation ±10% or less.
   b. Voltage imbalance ±3% or less.
   c. Frequency variation ±4% or less.
   d. Voltage distortion THD = 10% or less.

2. Installation measure :
   a. Use a filter designed for N300 inverter

3. Wiring
   a. Shielded wire (screened cable) is required for motor wiring, and the length must be less than 20 meters.
   b. The carrier frequency setting must be less than 5kHz to satisfy EMC requirements.
   c. Separate the main circuit from the signal/process circuit wiring.
   d. In case of remote operating with connector cable, the inverter does not conform to EMC.

4. Environmental conditions - when using a filter, follow these guidelines:
   a. Ambient air temperature : -10 - +50℃.
   b. Humidity : 20 to 90% RH(non-condensing)
   c. Vibration : 5.9 m/sec^2 (0.6 G) 10 - 55Hz (N300- 055 - 220LF / 055 - 220HF)
      2.94 m/sec^2 (0.6 G) 10 - 55Hz (N300- 300 - 550LF / 300 - 1320HF)
   d. Location : 1000meters of less altitude, indoors (no corrosive gas or dust)

Conformity to the Low Voltage Directive (LVD)

The protective enclosure must conform to the Low Voltage Directive.
The inverter can conform to the LVD by mounting into a cabinet or by adding covers as follows.

1. Cabinet and Cover
   The inverter must be installed into a cabinet which has the protection degree of Type IP2X.
   In addition the top surfaces of cabinet are easily accessible shall meet at least the requirements of the protective Type IP4X, or which is constructed to prevent small objects from entering inverter.

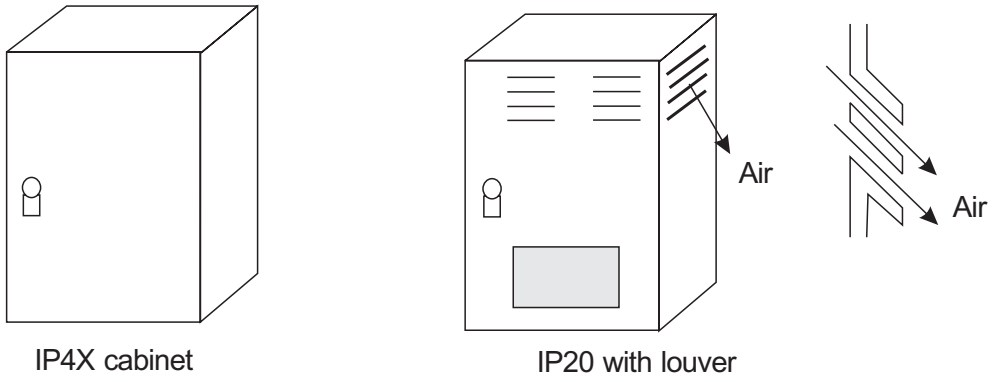

Fig. Inverter cabinet

UL Warnings and Cautions Manual for N300 series

This auxiliary instruction manual should be delivered to the end user.

1. Wiring warnings for Electrical Practices and Wire Specifications

WARNING : "Use 60/75℃ CU wire only" or equivalent.

WARNING : "Open Type Equipment."
For models with N300 750-1320H

WARNING : "Suitable for use on a circuit capable or delivering not more than 10,000 rms symmetrical amperes, 240V maximum. "For models with suffix L.

WARNING : "Suitable for use on a circuit capable or delivering not more than 10,000 rms symmetrical amperes, 480 V maximum." For models with suffix H.

2. Tightening Torque and Wire Range

WARNING : Tightening torque and wire range for field wiring terminals are marked adjacent to the terminal or on the wiring diagram.

Model Name	Tightening Torque [N·m]	Wire Range(AWG)
N300-055L	2.5	8
N300-075L	2.5	6
N300-110L	4.9	4
N300-150L	4.9	2
N300-185L	4.9	1
N300-220L	8.8	1/0
N300-300L	8.8	2/0
N300-370L	8.8	3/0 or 2 parallel of 1 AWG
N300-450L	13.7	250kcmil or 2 parallel of 1 AWG(75℃)
N300-550L	13.7	350kcmil or 2 parallel of 1/0 AWG

Model Name	Tightening Torque [N·m]	Wire Range(AWG)
N300-055H	2.5	12
N300-075H	2.5	10
N300-110H	4.9	8
N300-150H	4.9	6
N300-185H	4.9	6
N300-220H	4.9	4
N300-300H	4.9	3
N300-370H	4.9	1
N300-450H	8.8	1
N300-550H	8.8	1/0
N300-750H	8.8	250kcmil or 2 parallel of 1 AWG(75℃)
N300-900H	13.7	250kcmil or 2 parallel of 1 AWG(75℃)
N300-1100H	13.7	350kcmil or 2 parallel of 1/0 AWG
N300-1320H	13.7	2 parallel of 2/0 AWG

3. Circuit Breaker / Fuse Size

WARNING : Distribution fuse/circuit breaker size marking is included in the manual to indicate that the unit shall be connected with an UL Listed inverse time circuit breaker, rated 600V with the current ratings or an UL Listed fuse as shown in the table below.

Model Name	Circuit Breaker [A]	Fuse [A]
N300-055L	30	30
N300-075L	40	40
N300-110L	60	60
N300-150L	80	80
N300-185L	100	100
N300-220L	125	125
N300-300L	150	150
N300-370L	175	175
N300-450L	225	225
N300-550L	250	250

Model Name	Circuit Breaker [A]	Fuse [A]
N300-055H	15	15
N300-075H	20	20
N300-110H	30	30
N300-150H	40	40
N300-185H	50	50
N300-220H	60	60
N300-300H	70	70
N300-370H	90	90
N300-450H	125	125
N300-550H	125	125
N300-750H	-	175
N300-900H	-	200
N300-1100H	-	250
N300-1320H	-	300

4. Others

WARNING : "Field wiring connection must be made by an UL Listed and CSA Certified closed-loop terminal connector sized for the wire gauge involved.
Connector must be fixed using the crimp tool specified by the connector manufacturer.", or equivalent wording included in the manual.

Revision History Table

No	Revision Contents	The Date of Issue	Operation Manual Number
1	Initial Release of Manual NEJ 30204A	Apr. 2002	NEJ30204A
2	Manual Cover Contents Modification	Oct. 2002	HHIS-WZ-PE-005(02)
3	Parameter Initial Value Modification	Apr. 2004	HHIS-WZ-PE-005(03)

SAFETY PRECAUTIONS

1. Installation

⚠ CAUTION

- Be sure to install the unit on flame resistant material such as metal
  Otherwise, there is a danger of fire. ---------- P.2-2
- Be sure not to place anything inflammable in the vicinity.
  Otherwise, there is a danger of fire. ---------- P.2-2
- Do not carry unit by top cover, always carry by supporting base of unit.
  There is a risk of falling and injury. ---------- P.2-2
- Be sure not to let the foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, etc.
  Otherwise, there is a danger of fire. ---------- P.2-5
- Be sure to install it in a place which can bear the weight according to the specifications in the text. (Chapter 6. Specifications)
  Otherwise, it may fall and there is a danger of injury. ---------- P.2-1
- Be sure to install the unit on a perpendicular wall which is not subject to vibration
  Otherwise, it may fall and there is a danger of injury. ---------- P.2-3
- Be sure not to install and operate an inverter which is damaged or parts of which are missing
  Otherwise, there is a danger of injury. ---------- P.2-2
- Be sure install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.
  Otherwise, there is a danger off fire. ---------- P.2-2

SAFETY PRECAUTIONS

2. Wiring

⚠ WARNING

- Be sure to ground the unit.
  Otherwise, there is a danger of electric shock and/or fire. ---------- P.2-9

- Wiring work shall be carried out by electrical experts.
  Otherwise, there is a danger of electric shock and/or fire. ---------- P.2-6

- Implement wiring after checking that the power supply is off.
  It might incur electric shock and/of fire. ---------- P.2-8

- After installing the main body, carry out wiring.
  Otherwise, there is a danger of electric shock and/or injury. ---------- P.2-5

- Do not remove the rubber bush. (5.5 to 55kW)
  Due to the possibility that a wire may be damaged, shorted or may have a ground fault with the edge of the wiring cover. ---------- P.2-4

⚠ CAUTION

- Make sure that the input voltage is:
  Three phase 200 to 240V 50/60Hz(for models with suffix L)
  Three phase 380 to 480V 50/60Hz(for models with suffix H) ---------- P.2-6

- Be sure not to input a single phase.
  Otherwise, there is a danger of fire. ---------- P.2-8

- Be sure not connect AC power supply to the output terminals(U, V, W).
  Otherwise, there is a danger of injury and/or fire. ---------- P.2-5

- Be sure not to connect the resistor to DC terminals(PD, P and N) directly.
  Otherwise, there is a danger of fire. ---------- P.2-5

- Be sure to set the earth leakage breaker or the fuse(s)(the same phase as the main power supply) in the operation circuit.
  Otherwise, there is a danger of fire. ---------- P.2-12

- As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity(rated).
  Otherwise, there is a danger of fire. ---------- P.2-12

- Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter.
  Otherwise, there is a danger of injury and/or machine breakage. ---------- P.2-6

- Fasten the screws with the specified fastening torque. Check so that there is no loosening of screws.
  Otherwise, there is a danger of fire. ---------- P.2-12

SAFETY PRECAUTIONS

3. Control and operation

WARNING

- While the inverter is energized, be sure not to touch the main terminal or to check the signal or put on/off wire and/or connector. Otherwise, there is a danger of electric shock. ---------- P.3-1
- Be sure to turn on the input power supply after closing the front case. While being energized, be sure not to open the front case. Otherwise, there is a danger of electric shock. ---------- P.3-1
- Be sure not to operate the switches with wet hands. Otherwise, there is a danger of electric shock. ---------- P.3-1
- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage. Otherwise, there is a danger of electric shock. ---------- P.3-1
- If the retry mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine. (Be sure to design the machine so that personnel safety will be secured even if it restarts.) Otherwise, there is a danger of injury. ---------- P.3-1
- Be sure not to select retry mode for up and down equipment or traveling equipment, because there is output free-running mode in term of retry. Otherwise, there is a danger of injury and/or machine breakage. ---------- P.3-1
- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be sure to make a circuit so that it will not restart after power recovery. Otherwise, there is a danger of injury. ---------- P.3-1
- The stop key is effective only when the function is set. Be sure to prepare the key separately from the emergency stop. Otherwise, there is a danger of injury. ---------- P.3-1
- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off. Otherwise, there is a danger of injury. ---------- P.3-1
- Be sure not to touch the inside of the energized inverter or to put a bar into it. Otherwise, there is a danger of electric shock and/or fire. ---------- P.3-1

SAFETY PRECAUTIONS

CAUTION

- Cooling fin will have high temperature. Be sure not to touch them.
  Otherwise, there is a danger of getting burned. ---------- P.3-2

- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.
  Otherwise, there is a danger of injury. ---------- P.3-2

- Install external break system if needed.
  Otherwise, there is a danger of injury. ---------- P.3-2

- If a motor is operated at a frequency higher than standard setting value (50Hz/60Hz), be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them.
  Otherwise, there is a danger of machine breakage. ---------- P.3-2

- Check the following before and during the test run.
  Otherwise, there is a danger of machine breakage. ---------- P.3-2
  Was the direction of the motor correct?
  Was the inverter tripped during acceleration or deceleration?
  Were the rpm and frequency motor correct?
  Were there any abnormal motor vibrations or noise?

4. Maintenance, inspection and part replacement

WARNING

- After a lapse of more than 10 minutes after turning off the input power supply, perform the maintenance and inspection.
  Otherwise, there is a danger of electric shock. ---------- P.5-1

- Make sure that only qualified persons will perform maintenance, inspection and part replacement. (Before starting the work, remove metallic objects from your person(wristwatch, bracelet, etc.)
  (Be sure to use tools protected with insulation)
  Otherwise, there is a danger of electric shock and/or injury. ---------- P.5-1

5. Others

WARNING

- Never modify the unit.
  Otherwise, there is a danger of electric shock and/or injury.

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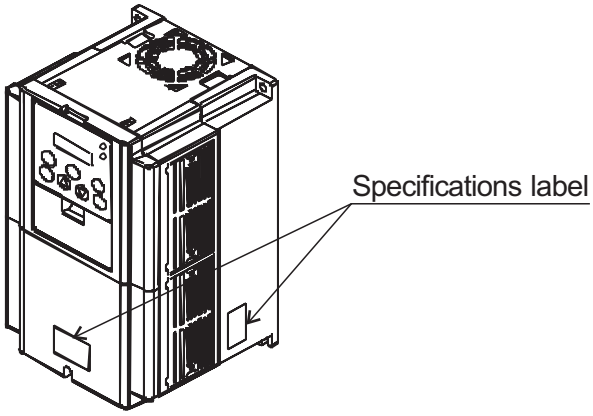
Chapter 1 General Descriptions

1.1 Inspection upon Unpacking

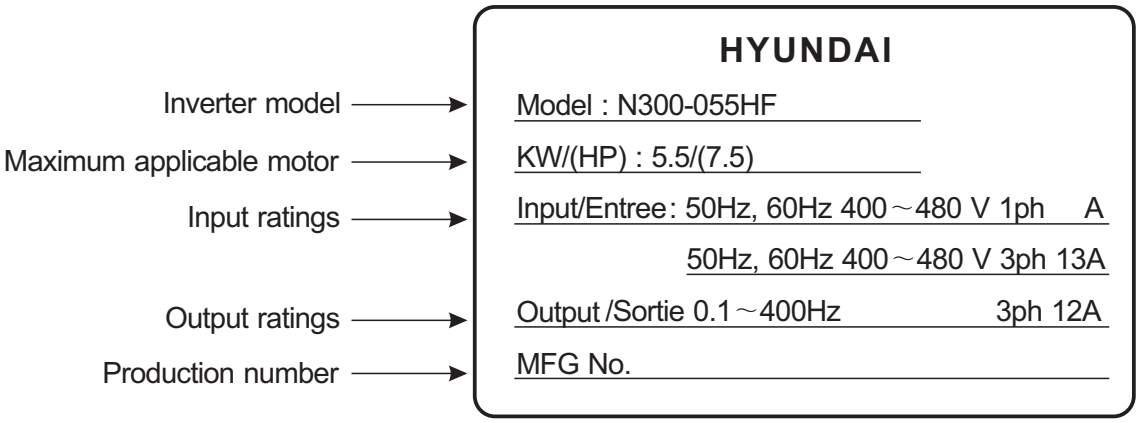
1.1.1 Inspection of the nuit

Open the package and pick out the inverter, please check the following item.
If you discover any unknown parts or the unit is in bad condition, please contact your supplier or the local HYUNDAI Distributor.

(1) Make sure that there was no damage (injury, falling or dents in the body) during transportation of the unit.
(2) After unpacking the unit, make sure that the package contains one operation manual for the Inverter.
(3) Make sure that the product is the one you ordered by checking the specification label.



Picture 1-1 Position of specification label



Picture 1-2 Contents of specification label

1.1.2 Instruction manual

This instruction manual is the manual for the HYUNDAI Inverter N300 Series.
Before operation of the Inverter, read the manual carefully. After Reading this manual, keep it to hand for future reference.
When using optional units for this inverter ; please refer to the instruction manuals packed with the optional units.
This instruction manual should be delivered to the end user.

Chapter 1 General Descriptions

1.2 Question and Warranty of the Unit

1.2.1 Request upon asking

If you have any questions regarding damage to the unit, unknown parts or for general enquiries please contact your supplier or the local HYUNDAI Distributor with the following information.

(1) Inverter Model
(2) Production Number (MFG No.)
(3) Date of purchase
(4) Reason for Calling
Damaged part and its condition etc.
Unknown parts and their contents etc.

1.2.2 Warranty for the unit

The warranty period of the unit is one year after the purchase date. However within the warranty period, the warranty will be void if the fault is due to;
(1) Incorrect use as directed in this manual, or attempted repair by unauthorized personnel.
(2) Any damage sustained other than from transportation (Which should be reported immediately).
(3) Using the unit beyond the limits of the specification.
(4) Natural Disasters : Earthquakes, Lightning, etc

The warranty is for inverter only, any damage caused to other equipment by malfunction of the inverter is not covered by the warranty.

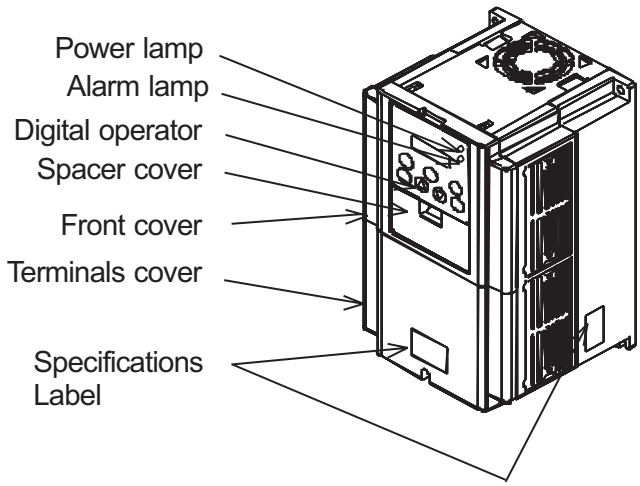
Any examination or repair after the warranty period (one-year) is not covered. And within the warranty period any repair and examination which results in information showing the fault was caused by any of the items mentioned above, the repair and examination cost are not covered. If you have any questions regarding the warranty please contact either your supplier or the local HYUNDAI Distributor.
Please refer to the back cover for a list of the local HYUNDAI Distributors.

Chapter 1 General Descriptions

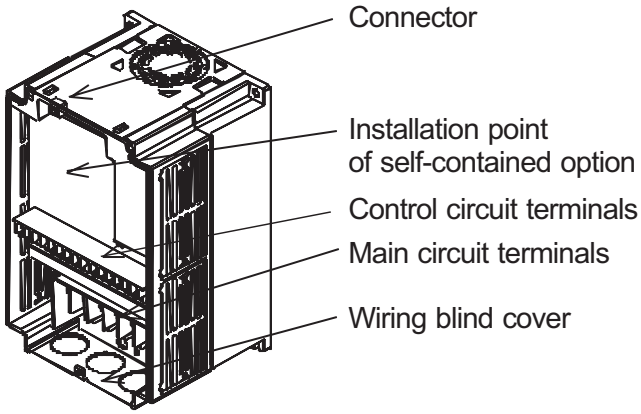
1.3 Appearance

1.3.1 Appearance and Names of Parts

Appearance from the front



Front cover removed



(Note) When you use cable for remote operation, please remove connector.

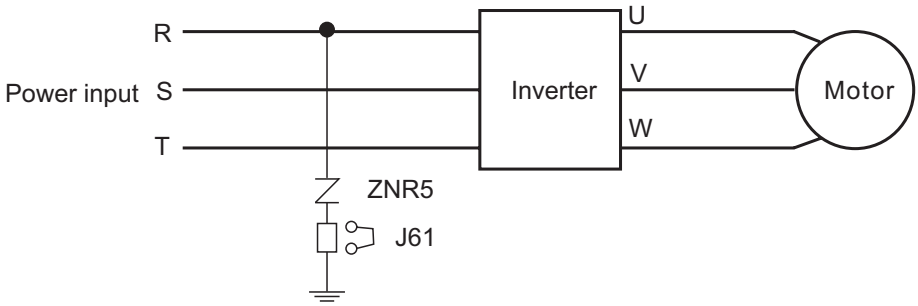
Chapter 1 General Descriptions

1.4 Application Method for J61 Connector Pin according to Input Power Grounding Condition

1.4.1 Usage of J61 Connector Pin and its application

(1) Usage of J61 Connector Pin

- For N300 Inverter, a protection circuit is built-in case of lightning while being used, and it can be also protected when J61 Connector Pin is connected.



However, the Inverter can be seriously affected according to its grounding condition(grounding or non-grounding) of input transformer.

As a result, when Inverter products are yielded, J61 Connector Pin is separately provided (open condition). Users should choose a set of J61 Connector Pin according to the second grounding condition of input power as the below picture after deep consideration of your field situation.

- J61 Connector Pin Applying Condition according to grounding -

Grounding condition	Wiring Diagram of Input	Applying Condition of J61 Connector Pin	Remarks
Grounding	First Second △ Y Or First Second Y △	Available for J61 Connector Pin	See Application Method of Connector in Chapter 1.4.2
Non-grounding	First Second △ Y Or First Second Y △	Running open of J61 Connector Pin (not connected)	Original Product

(2) Comparison according to J61 Connector Pin Using or Non-using

a) Advantage of using J61 Connector Pin

- Electronic products are often damaged by lightning or thunderbolt due to its sensitivity for the weather changing. For N300 Inverter, a protection circuit is built-in to protect the inverter from lightning or thunderbolt by using J61 Connector Pin.
- ⚠ Pre-caution

  You should confirm the grounding condition of power source.

  When using the second inverter(inverter power input), you should confirm if Y wiring is in neutral ground system and if △ wiring is in upper ground system. If you use J61 Connector Pin in non-grounding system, Inverter can be easily damaged by excessive noise from being expressed through ZNR .

Chapter 1 General Descriptions

b) Features of Non-using J61 Connector Pin

- Although any transformer products are not grounded, there is little damage of Inverter due to no corruption in ZNR, as noise is intercepted from electric panel.
- ⚠Attention

  It is not protected from the whether changing such as lightning.

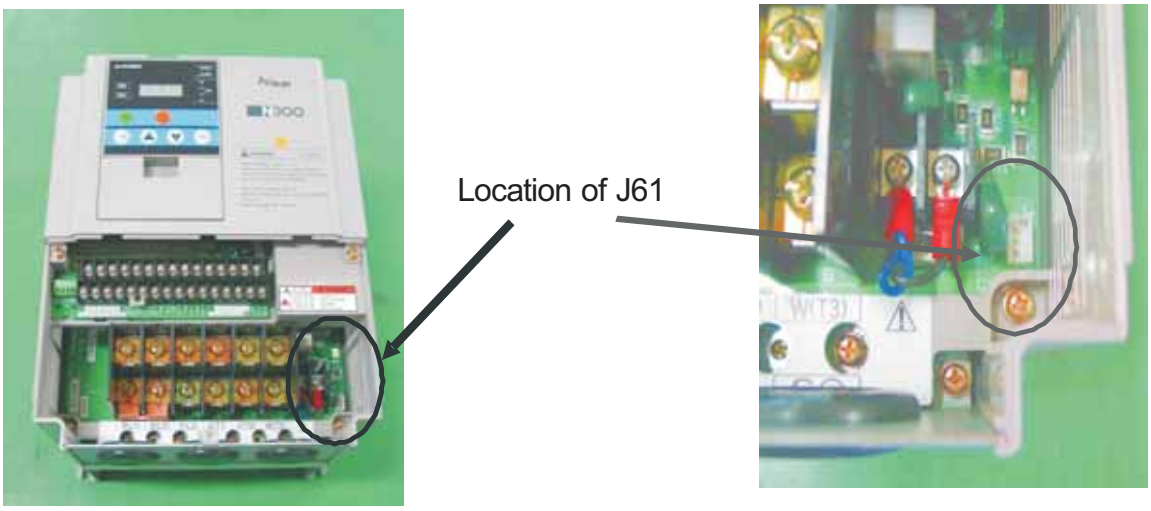
c) Inquiry about J61 Connector

- If you have any technical inquires about grounding and J61 Connector, please contact our company.

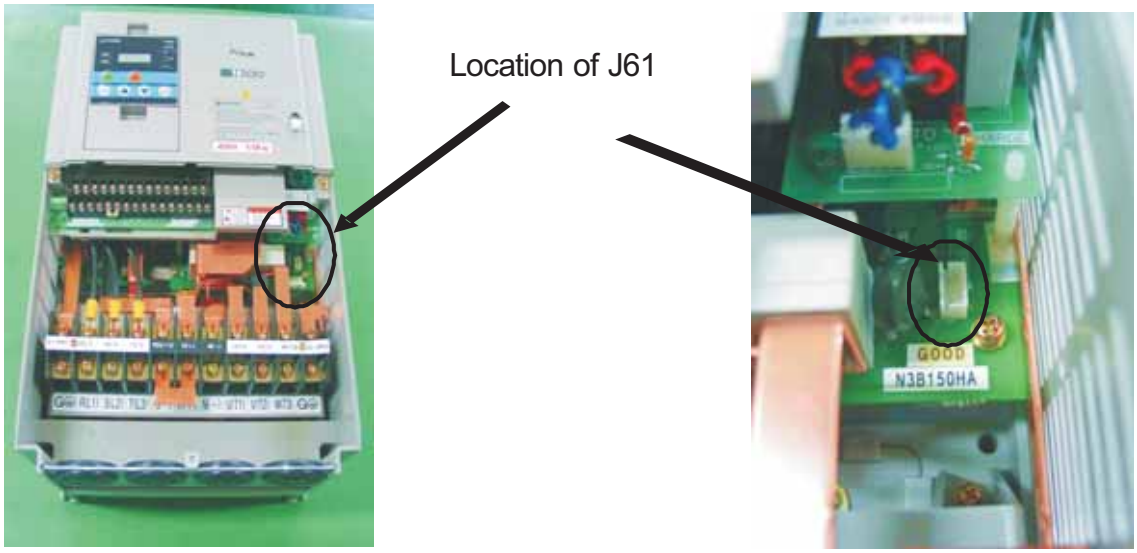
1.4.2. Application of Connector Pin

(1) Location of J61 Connector Pin according to N300 Inverter Capacity

a) 5.5KW ~ 11KW Inverter Capacity (the same location as 200V Supply & 400V Supply)

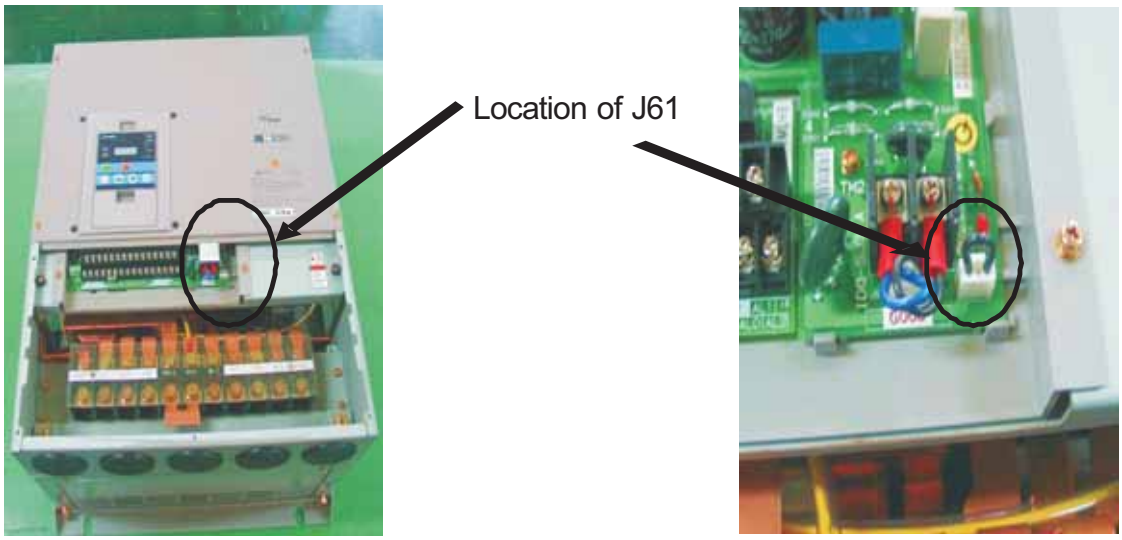


b) 15KW ~ 22KW Inverter Capacity (the same location as 200V Supply & 400V Supply)



Chapter 1 General Descriptions

c) 30KW ~ 132KW Inverter Capacity (the same location as 200V Supply & 400V Supply)



(2) Application Method of J61 Connector

* Sequencing of Application *

- You should turn off the power, after halting Inverter working.
- You should open the Inverter cover located in the bottom level. At this very moment, you should use Meta and confirm if DC voltage between P and N is completely discharged.
- As J61 is in a different location according to Inverter capacity, you should confirm if J61 is in the right location. For J61 Connector Pin, 5.5KW~22KW Inverter capacity is located in the bottom right of IGBT PCB and 30KW~132KW Inverter capacity is in the bottom right of Ro-To PCB.
- After checking out its location, you should connect Jump line(ending line) to J61 connector.
- You should close the bottom cover after application.
- You should operate the machine after turning on the Inverter power.

(3) Important items when applying J61 Connector Pin

- You should decide if you use J61 Connector Pin for Inverter before applying panel.
  If using J61 Connector on the purpose of protection for lightning, you should halt Inverter working, turn off the power, and connect to it.
  You may have an electric shock.
- Also, You should apply J61 Connector pin, after checking out if DC voltage between P and N is completely discharged by using Meta.
- After application, you should turn on the power after closing the Inverter cover.
  You may have an electric shock.
- If you have any inquiries about J 61 Connector, please contact our company.

Chapter 2 Installation and Wiring

2.1 Installation

CAUTION

- Be sure to install the unit on flame resistant material such as metal.
  Otherwise, there is a danger of fire.

- Be sure to place anything inflammable in the vicinity.
  Otherwise, there is a danger of fire.

- Do not carry unit by top cover, always carry by supporting base of unit.
  There is a risk of falling and injury.

- Be sure not to let the foreign matter enter such as cut wire refuse, spatter from welding, iron refuse, wire, dust, ect.
  Otherwise, there is a danger of fire.

- Be sure to install it in a place which can bear the weight according to the specifications in the text. (Chapter 6. Specifications)
  Otherwise, it may fall and there is a danger of injury.

- Be sure to install the unit on a perpendicular wall which is not subject to vibration.
  Otherwise, it may fall and there is a danger of injury.

- Be sure not to install and operate an inverter which is damaged or parts of which are missing.
  Otherwise, there is a danger of injury.

- Be sure to install it in a room which is not exposed to direct sunlight and is well ventilated. Avoid environments which tend to be high in temperature, high in humidity or to have dew condensation, as well as places with dust, corrosive gas, explosive gas, inflammable gas, grinding-fluid mist, salt damage, etc.
  Otherwise, there is a danger of fire.

Chapter 2 Installation and Wiring

2.1.1 Installation

1. Transportation

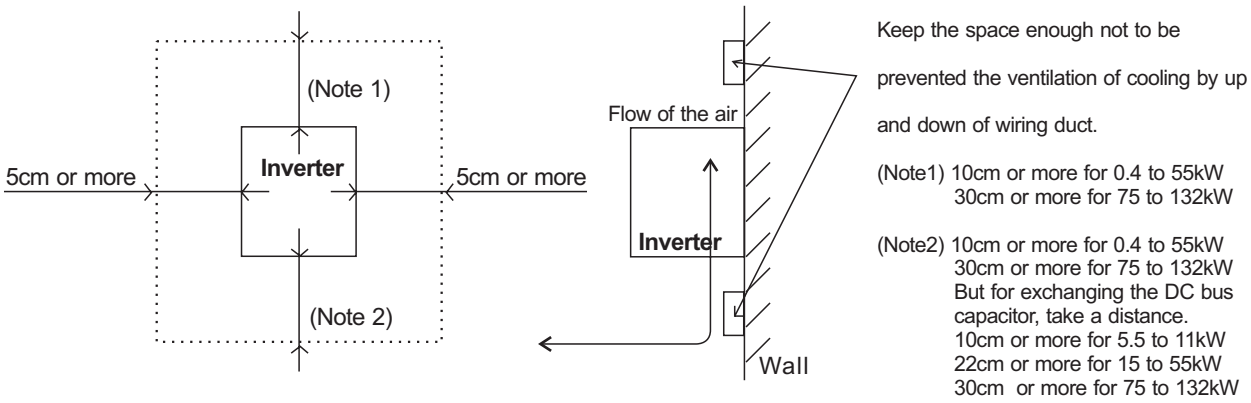
   This inverter has plastic parts. So handle with care.

   Do not over tighten the wall mounting fixings as the mountings may crack, causing is a risk of falling.

   Do not install or operate the inverter if there appears to be damage or parts missing.

2. Surface for Mounting of Inverter

   The temperature of the Inverter heatsink can become very high (the highest being about 150℃). The surface, which you are mounting the Inverter onto, must be made of a non-flammable material (i.e steel) due to the possible risk of fire. Attention should also be mabe to the air gap surrounding the Inverter. Especially when there is a heat source such as a breaking resistor or reactor.


(Note 1)
5cm or more
Inverter
5cm or more
(Note 2)
Flow of the air
Inverter
Wall
Keep the space enough not to be
prevented the ventilation of cooling by up
and down of wiring duct.
(Note1) 10cm or more for 0.4 to 55kW
30cm or more for 75 to 132kW
(Note2) 10cm or more for 0.4 to 55kW
30cm or more for 75 to 132kW
But for exchanging the DC bus
capacitor, take a distance.
10cm or more for 5.5 to 11kW
22cm or more for 15 to 55kW
30cm or more for 75 to 132kW

3. Operating Environment-Ambient Temperature

   The ambient temperature surrounding the Inverter should not exceed the allowable temperature range (-10 to 50℃).

   The temperature should be measured in the air gap surrounding the Inverter, shown in the diagram above. If the temperature exceeds the allowable temperature, the component life will become shortened especially in the case of the Capacitors.

4. Operating Environment-Humidity

   The humidity surrounding the Inverter should be within the limit of the allowable percentage range (20% to 90%).

   Under no circumstances should the Inverter be in an environment where there is the possibility of moisture entering the Inverter.

   Also avoid having the Inverter mounted in a place that is exposed to the direct sunlight.

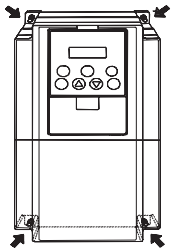
Chapter 2 Installation and Wiring

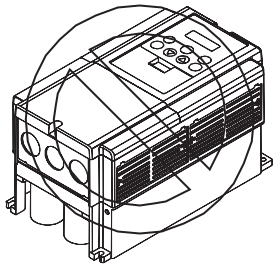
5. Operating Environment-Air

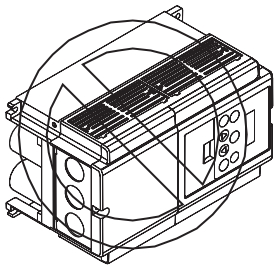
Install the Inverter avoiding any place that has dust, corrosive gas, explosive gas, combustible gas, mist of coolant and sea damage.

6. Mounting Position

Mount the Inverter in a vertical position using screws or bolts. The surface you mount onto should also be free from vibration and can easily hold the weight of the Inverter.

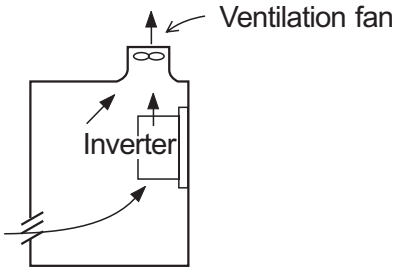




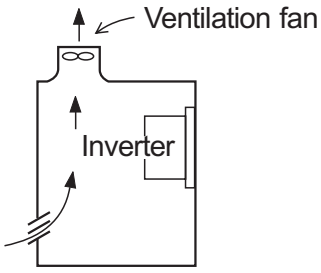


7. Ventilation within an Enclosure

If you are installing one or more Inverters in an enclosure a ventilation fan should be installed. Below is a guide to the positioning of the fan to take the airflow into consideration. The positioning of Inverter, cooling fans and air intake is very important. If these positions are wrong, airflow around the Inverter decreases and the temperature surrounding the Inverter will rise. So please make sure that the temperature around is within the limit of the allowable range.



(Good example)



(Bad example)

8. External cooling of Inverter

It is possible to install the inverter so that the heatsink is out of the back of the enclosure.
This method has two advantages, cooling of the inverter is greatly increased and the size of the enclosure will be smaller.
To install it with the heatsink out of the enclosure, a metal fitting option is required to ensure heat transfer. Do not install in a place where water oil mist flour and dust etc can come in contact with the inverter as there are cooling fans fitted to the heatsink.

9. Approximate loss for each capacity

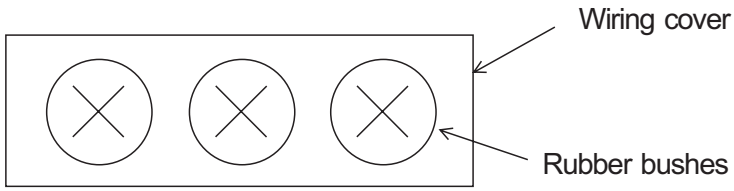
Inverter capacity(kw)	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
70% of rated output(w)	242	312	435	575	698	820	1100	1345	1625	1975	2675	3375	3900	4670
100% of rated output(w)	325	425	600	800	975	1150	1550	1900	2300	2800	3800	4800	5550	6650
100% of rated efficiency(%)	94.4	94.6	94.8	94.9	95.0	95.0	95.1	95.1	95.1	95.1	95.2	95.2	95.2	95.2

Chapter 2 Installation and Wiring

2.1.2 Blind cover of wiring parts (5.5 to 55kW)

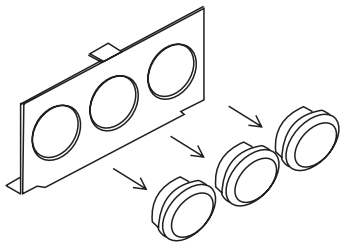
(1) Cable entry through Rubber Bushes

The wiring should be done after making a cut in the rubber bushes with nippers or cutters.



(2) Cable entry through Conduit

After taking out the rubber bushes, connect the conduit.



(Note) Except for when connecting conduit, do not take out the rubber bushes. It is possible that the wiring insulation is broken and a possible earth fault is caused.

Chapter 2 Installation and Wiring

2.2 Wiring

WARNING

- Be sure to ground the unit.
  Otherwise, there is a danger of electric shock and/or fire.

- Wiring work shall be carried out by electrical experts.
  Otherwise, there is a danger of electric shock and/or fire.

- Implement wiring after checking that the power supply is off.
  It might incur electric shock and/or fire.

- After installing the main body, carry out wiring.
  Otherwise, there is a danger of electric shock and/or injury.

- Do not remove the rubber bush. (5.5 to 55kW)
  Due to the possibility that a wire may be damaged, shorted or may have a ground fault with the edge of the wiring cover

CAUTION

- Make sure that the input voltage is:
  Three phase 200 to 240V 50/60Hz (for models with suffix L)
  Three phase 380 to 480V 50/60Hz (for models with suffix H)

- Be sure not to input a single phase.
  Otherwise, there is a danger of fire.

- Be sure not to connect AC power supply to the output terminals (U, V, W).
  Otherwise, there is a danger of injury and/or fire.

- Be sure not to connect the resistor to DC terminals (PD, P and N) directly.
  Otherwise, there is a danger of fire.

- Be sure to set the earth leakage breaker or the fuse(s) (the same phase as the main power supply) in the operation circuit.
  Otherwise, there is a danger of fire.

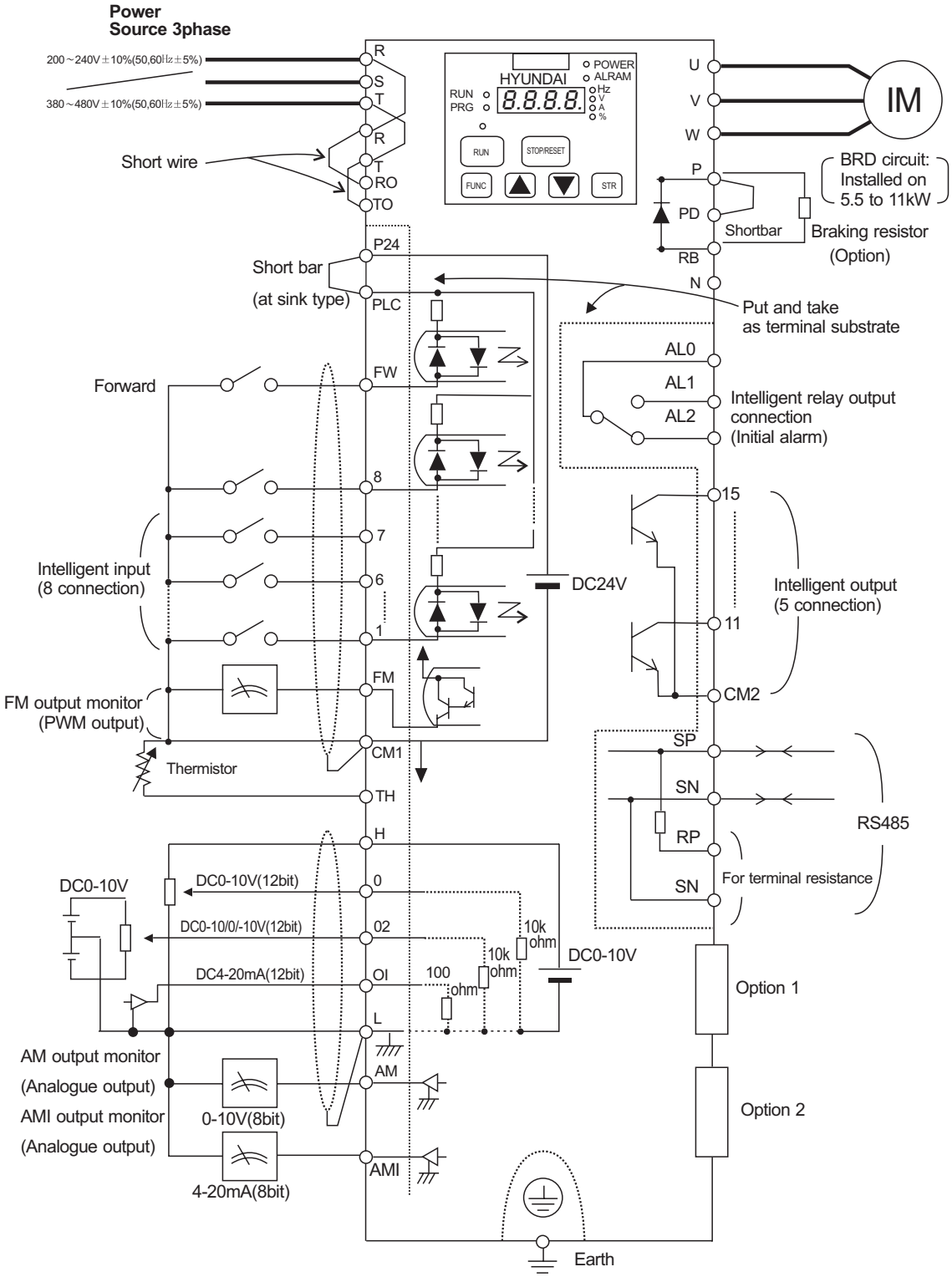
- As for motor leads, earth leakage breakers and electromagnetic contactors, be sure to use the equivalent ones with the specified capacity (rated).
  Otherwise, there is a danger of fire.

- Do not stop operation by switching off the electromagnetic contactors on the primary or secondary sides of the inverter.
  Otherwise, there is a danger of injury and/or machine breakage.

- Fasten the screws with the specified fastening torque. Check so that there is no loosening of screws.
  Otherwise, there is a danger of fire.

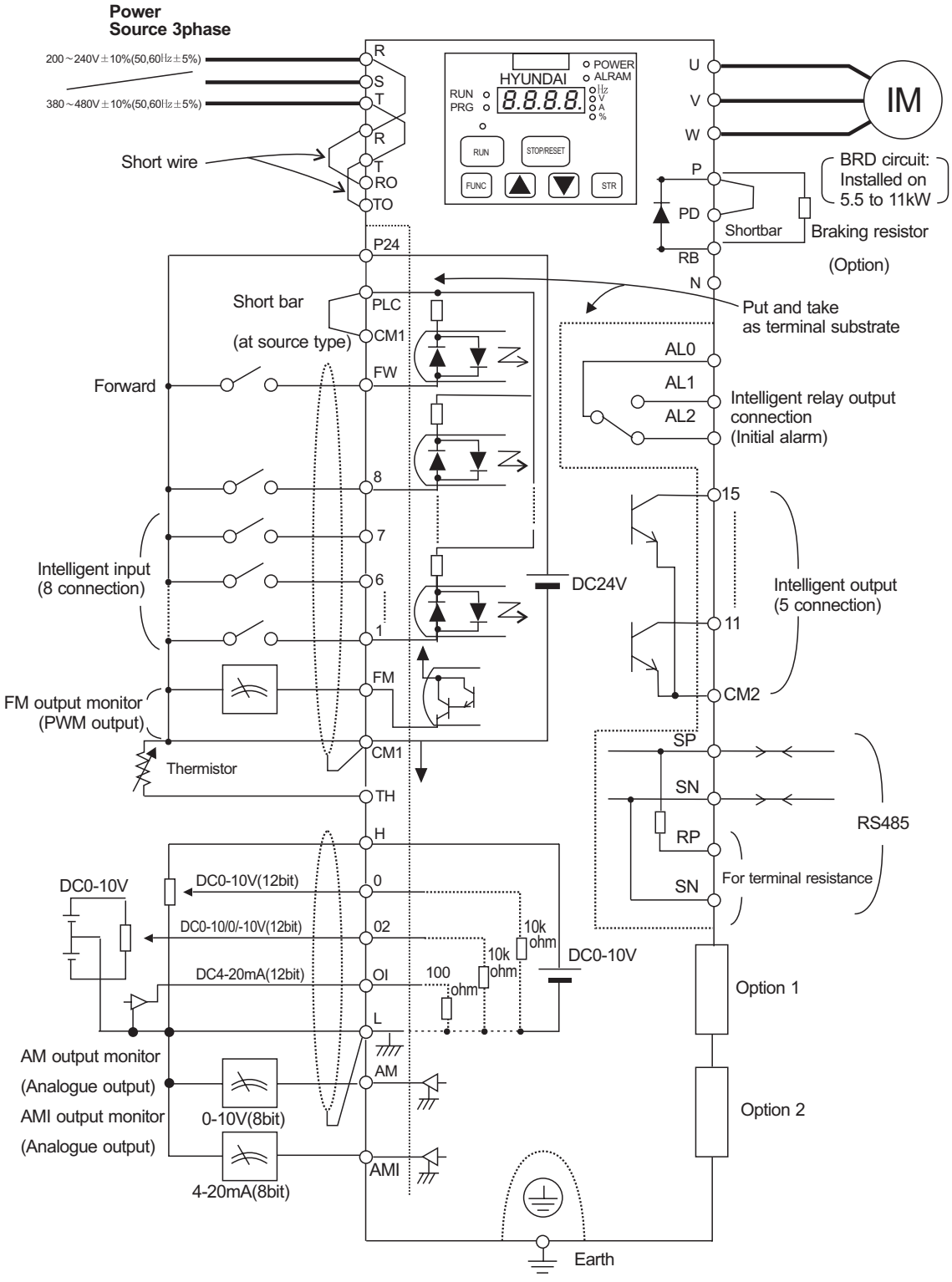
Chapter 2 Installation and Wiring

2.2.1 Terminal Connection Diagram (sink type)



Chapter 2 Installation and Wiring

2.2.1 Terminal Connection Diagram (source type)



Chapter 2 Installation and Wiring

(1) Explanation of main circuit terminals

Symbol	Terminal Name	Explanation of contents
R,S,T (L1,L2,L3)	Main power	Connect alternating power supply.
U, V, W (T1,T2,T3)	Inverter output	Connect three- phase motor.
PD,P (+1,+)	D.C reactor	Remove the short bar between PD and P, connect optional power factor reactor(DCL)
P,RB (+,RB)	External braking resistor	Connect optional External braking resistor. (Installed on 5.5kW to 11kW)
P,N (+,-)	External Regenerative unit	Connect optional Regenerative braking unit (BRD).
G	Inverter earth terminals	It is earth terminals of inverter case.

(2) Explanation of control circuit terminal

	Symbol			Terminal Name	Explanation of contents	
Analogue	Power Source		L	Analogue power common	It is common terminal of frequency command signal(O, O2, OI) and analogue output, AM, AMI. Don"t earth.	
			H	Frequency power	It is the DC+10V power for terminals.	Allowable load current 20mA
	Frequency setting		O	Frequency command power terminal(voltage)	When inputting DC 0 ~10V, it is maximum frequency on 10V. When maximum frequency is expected to be on being less then 10V, set with A014	Input Impedance 10K ohm Allowable maximum voltage 12V
			O2	Frequency command support(voltage)	When inputting DC 0 ~±10V, this signal is added to frequency command of O or OI terminal.	Input Impedance 10K ohm Allowable maximum load current 20mA
			OI	Frequency command Terminal (current)	When inputting DC 4 ~20mA, 20mA is maximum frequency. When only terminal is ON, this input signals is effective.	Input Impedance 100 ohm Allowable maximum current 24mA
	Monitor		AM	Digital monitor (voltage)	Output one selected from monitor item, output frequency, output current, torque, output voltage, input electric power, electric thermal rate, LAD frequency	Allowable maximum current 2mA
			AMI	Analogue monitor (Current)		Allowable output less then impedance 250 ohm
Digitasl(connection)			FM	Digital monitor (Voltage)	Output the output frequency with digital besides above monitor.	Allowable maximum current1.2mA Maximum frequency 3.6kHz
	Power Source		P24	Interface power	It is DC24V power for connection input signal. When selecting source logic, it's connection input common	Allowable maximum output current 100mA
			CM1	Interface power common	The common terminal is FW terminal, 1-8 terminal, TH terminal, FM terminal, Don't earth.	
			PLC	Intelligent input common	Change sink type and source type by short bar on control terminals. P24-PLC : Sink type CM1-PLC : Source type	
	Input signal	setting	FW	Forward command	About FW signal, ON is Forward and OFF is stop command.	Allowable maximum voltage 27V Input ON condition of terminal voltage Over 18V Input OFF condition of terminal voltage under 3 V Input impedance 4.7k ohm
		operation/Function Selection etc	1(RS) 2(AT) 3(JG) 4(FRS) 5(2CH) 6(CF2) 7(CF1) 8(RV)	Input intelligent	Select 8 function from 44 functions, and divide between 1 terminal and 8 terminals.	
	Output signal	Cindition/Alarm	11(FA1) 12(RUN) 13(OL) 14(OTQ) 15(IP)	input Intelligent	Select 5 function from 22 functions, and divide between 1 terminal and 5 terminals.	Allowable maximum voltage 27V current 50mA
			AL0	Common terminal	It is common terminal of alarm output terminal	Allowable minimum AC250V, 0.2A Allowable minimum AC100V,10mA
			AL1 AL2	Alarm output terminal	Assign output function. Output is c contact	
Analogue	Sensor		TH	Thermistor input terminal	When a Thermistor connected to terminals TH and CM1, the inverter checks for over-temperature and will cause trip event and turn off output to motor.	Allowable minimum Thermistor power 100mW

Chapter 2 Installation and Wiring

2.2.2 Main circuit wiring

(1) Warning on wiring

When carrying out work on the Inverter wiring make sure to wait for at least ten minutes before you remove the cover. Making sure to check that the charge lamp is not illuminated.

A final check should always be made with a voltage meter.

After removing the power supply, there is a time delay before the capacitors will dissipate charge.

1. Main power terminals (R, S, T)

Connect the main power terminals (R, S and T) to the power supply through a electromagnetic contactor or an earth-leakage breaker.

We recommend connecting the electromagnetic contactor to the main power terminals.

Because when the protective function of inverter operates, it isolates the powers supply and prevent the spread of damages and accidents.

This unit is for three-phase power supply. It isn't for the single-phase power supply. If you require a single phase power supply unit, please contact us.

- Don't operate with on/off of the switch set up in the converter side and the inverter side. Do an operation stop by the operation order (FW / RV) terminals.
- This inverter becomes the following condition at the time of open phase because open phase protection is being made ineffective by the early data.

  R phase or T phase, open phase condition: The power isn't turned on, and it doesn't operate.

  S phase, open phase condition: It becomes single-phase operation condition. Trip operation such as a deficiency voltage or over current may be done. Don't use it under open phase condition.
- A converter module may be damaged in the case shown below. Be careful.

  When an unbalance of the power supply voltage is more than 3%.

  Power supply capacity, 10 times of the capacity of inverter and case beyond 500kVA.

  When a change in the rapid power supply voltage occur.

  (Example) When inverter of the plural is installed with the common electric wire whose it is short by each other. When there is insertion of the condenser or a removal.
- On/off of the power supply isn't to do it more than three times in one minute.

  It has the possibility that inverter is damaged.

2. Inverter output terminals (U, V, and W)

- Wire with thicker wire than the applicable wire to control the voltage drop.

  Particularly when outputting low frequencies, the torque of the motor will reduce by the voltage drop of the wire.
- Do not install power factor correction capacitors or a surge absorber to the output.

  The inverter will trip or sustain damage to the capacitors or the surge absorber.
- In the case of the cable length being more than 20 meters, it is possible that a surge voltage will be generated and damage to the motor is caused by the floating capacity or the inductance in the wire (400V especially). An EMC Mains Filter is available, please contact us.
- In the case of two or more motors, install a thermal relay to each motor.
- Make the RC value of the thermal relay the value of 1.1 times of motor rated electric current.

  Install output ACL when a life becomes short by the length of wiring.

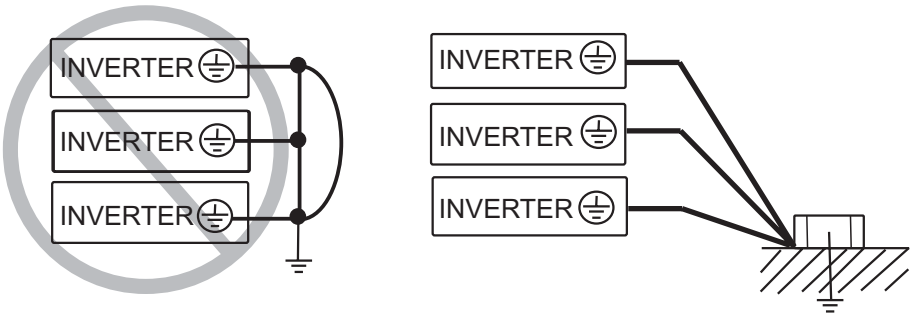
Chapter 2 Installation and Wiring

3. Direct current reactor (DCL) connection terminals (PD, P)
- These are the terminals to connect the current reactor DCL (Option) to help improve the power factor.
- The short bar is connected to the terminals when shipped from the factory, if you are to connect a DCL you will need to disconnect the short bar first.
- When you dont' use a DCL, don't disconnect the short bar.

4. External braking resistor connection terminals (P, RB)
- The regenerative braking circuit (BRD) is built-in as standard up to the 11kW Inverter. When braking is required, install an external-braking resistor to these terminals.
- The cable length should be less than 5 meters, and twist the two connecting wires to reduce inductance.
- Don't connect any other device other than the external braking resistor to these terminals.
- When installing an external braking resistor make sure that the resistance is correctly rated to limit the current drawn through the BRD.

5. Regenerative breaking unit connection terminals (P, N)
- The Inverters rated more than 15kW don't contain a BRD circuit. If regenerative braking is required an external BRD circuit (Option) is required along with the resistor (Option).
- Connect external regenerative braking unit terminals (P, N) to terminals (P, N) on the inverter. The braking resistor is then wired into the External Braking unit and not directly to the Inverter.
- The cable length should be less than 5 meters, and twist the two connecting wires to reduce inductance.

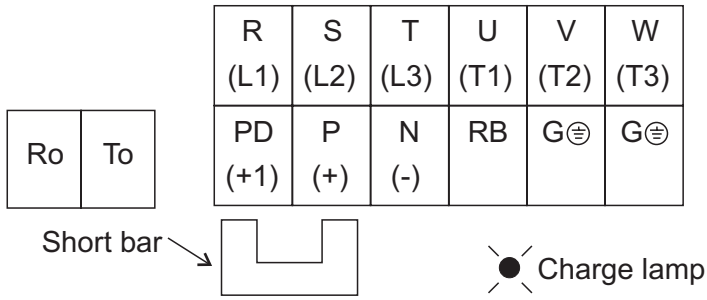
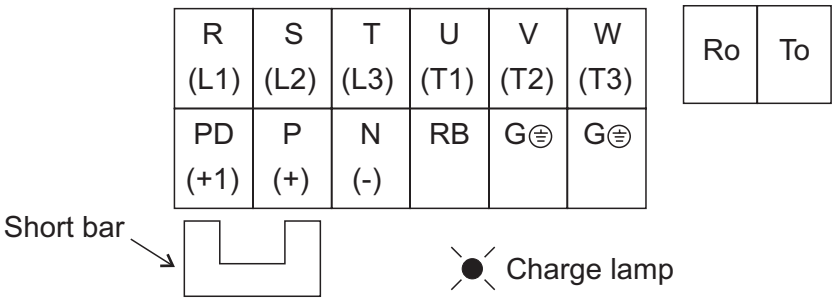
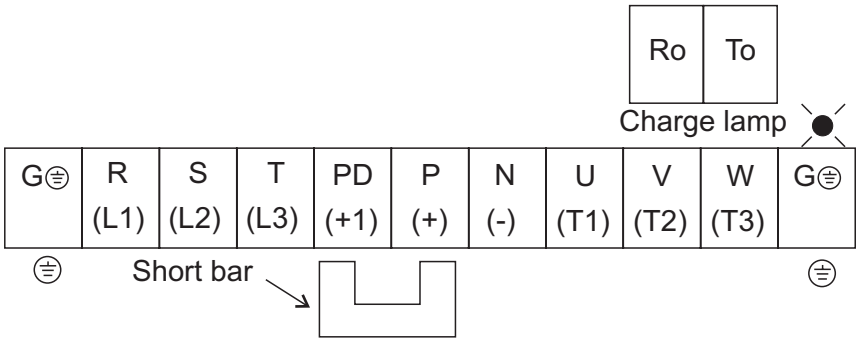
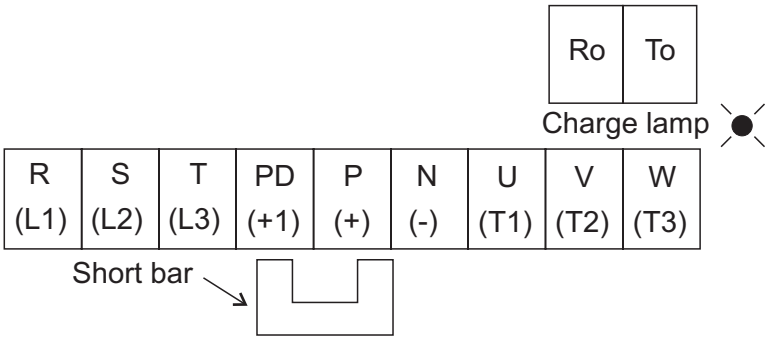
6. Earth (G ⏚)
- Make sure that you securely ground the Inverter and motor for prevention of electric shock.
- The inverter and motor must be connected to an appropriate safety earth and follow the local standard. Failure to do so constitutes an electrical shock hazard.



Chapter 2 Installation and Wiring

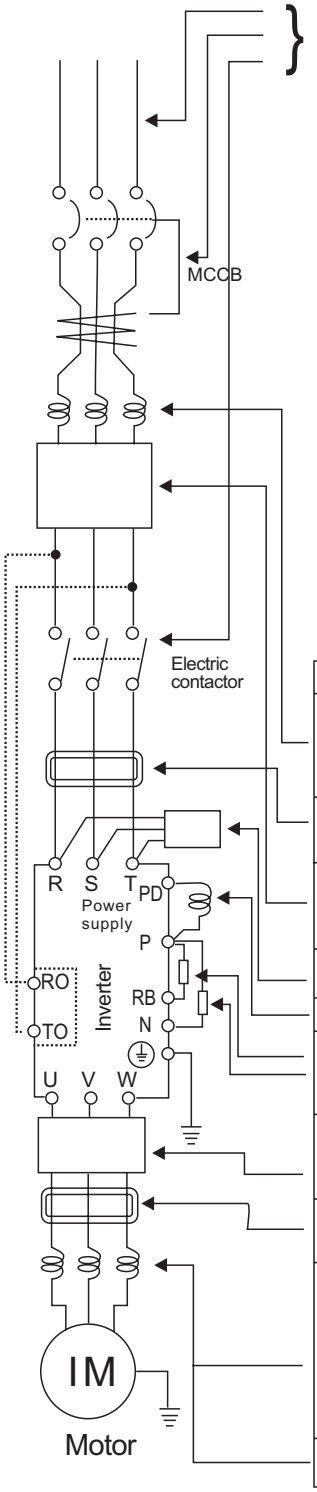
(2) Wiring of main circuit terminals

The wiring of main circuit terminals for inverter is the following picture.

Wiring of terminals	Corresponding type
	N300-055LF/HF Ro-To : M4 Other : M5
	N300-075LF/HF Ro-To : M4 Other : M5 N300-100LF/HF Ro-To : M4 Other : M6
	N300-150,185LF N300-150-370HF Ro-To : M4 Other : M6 N300-300,370LF N300-450, 550HF Ro-To : M4 Other : M8
	N300-220LF Ro-To : M4 Earth terminal : M6 Other : M8 N300-450,550LF N300-750-1320HF Ro-To : M4 Earth terminal : M8 Other : M10

Chapter 2 Installation and Wiring

(3) Wiring Equipment



Refer to "(4) Common applicable tools"

(Note1) The applicable tools indicate for Hyundai standard four-pole squirrel-cage Motor

(Note2) Select applicable tools for breakers examining the capacity of breakers.
(Use Inverter type.)

(Note3) Use earth-leakage breakers (MCCB) for safety.

(Note4) Use 60/75℃ copper electric wire.

(Note5) It needs bigger wires for power lines, if the distance exceeds 20m.

(Note6) Use 0.75mm^2 for Alarm output contact.

(Note7) Separate by the sum wiring distance from Inverter to power supply, from inverter to motor for the sensitive current of leak breaker (MCCB)

Wiring distance	Sensitive Current (mA)
100m and less	50
300m and less	100

(Note8) When using CV wire and wiring by rigid metal conduit, leak flows.

(Note9) IV wire is high dielectric constant. So the current increase 8 times.
Therefore, use the sensitive current 8 times as large as that of the left list.
And if the distance of wire is over 100m, use CV wire.

Name	Function
Input reactor(harmonic control, electrical coordination, power factor improvement) (ACL-□I-□□□□)	This part is used when the nubalance voltage rate is 3% or more and power supply is 500KVA or more, and there is a rapid change in the power supply. It also improves the power factor.
Radio noise filter (zero-phase reactor)	Using the the inverter may cause noise on the peripheral radio through the power lines. This part reduces noise.
Noise filter for Inverter (□T3AK-□□□□)	This part reduces common noise generated between the power supply and ground, as well as normal noise. Put it in the primary side of inverter.
Input radio noise filter (capacitor filter)	This part reduces radiation noise emitted from wire at the input
Direct reactor(DCL-*-**)	This part control harmonic from inverter.
Breaking resistor Regenerative breaking unit	This part is used for applications that need to increase the brake torque of the inverter or to frequently turn on and off and to run high inertia load.
Output noise filter (□T3CZ-□□□□)	This part reduces radiation noise emitted from wire by setting between inverter and motor. And it reduces wave fault to radio and TV, it is used for preventing malfunction of sensor and measuring instruments.
Radio noise filter(zero-phase reactor)	This part reduces noise generated at the output of the inverter. (It is possible to use for both input and output)
Output alternation reactor Reducing vibration, thermal Relay, preventing misapplication (ACL-□-□□□□)	Running motors with the inverter generates vibration greater than that with commercial power supply. This part installed between the inverter and motor reduces torque ripple. When the cable length between the inverter and motor is long (10m or more), a countermeasure for a malfunction of the thermal relay by harmonic due to switching on inverter is taken by inserting reactor. There is the way to use current sensor in stead of thermal relay.
LCR filter	Sine-wave filter at the output.

Chapter 2 Installation and Wiring

(4) Common applicable tools

	Motor output (kw)	Applicable Inverter Model	Power lines R, S,T,U,V,W, P,PD,N	External resister between P and RB	Screw size of Terminal	Torque (N.m)	Applicable Tools		
							Leak breaker (MCCB)		Electromagnetic controller (MC)
200V class	5.5	N300-055LF	5.5	5.5	M5	2.0	HBS60N	50A	H¿Mc22
	7.5	N300-075LF	8	5.5	M5	2.0	HBS60N	50A	H¿Mc32
	11	N300-110LF	14	5.5	M6	2.5	HBS100N	75A	H¿Mc50
	15	N300-150LF	22	-	M6	2.5	HBS100N	100A	H¿Mc65
	18.5	N300-185LF	30	-	M6	2.5	HBS225N	150A	H¿Mc80
	22	N300-220LF	38	-	M8	6.0	HBS225N	150A	H¿Mc80
	30	N300-300LF	60 (22×2)	-	M8	6.0	HBS225N	200A	H¿Mc110
	37	N300-370LF	100 (38×2)	-	M8	6.0	HBS225N	225A	H¿Mc130
	45	N300-450LF	100 (38×2)	-	M10	10.0	HBS400N	225A	H¿Mc180
	55	N300-550LF	150 (60×2)	-	M10	10.0	HBS400N	350A	H¿Mc220
400V class	5.5	N300-055HF	3.5	3.5	M5	2.0	HBS30N	30A	H¿Mc18
	7.5	N300-075HF	3.5	3.5	M5	2.0	HBS30N	30A	H¿Mc18
	11	N300-110HF	5.5	5.5	M6	2.5	HBS60N	50A	H¿Mc32
	15	N300-150HF	8	-	M6	2.5	HBS100N	50A	H¿Mc40
	18.5	N300-185HF	14	-	M6	2.5	HBS100N	75A	H¿Mc40
	22	N300-220HF	22	-	M6	2.5	HBS100N	75A	H¿Mc50
	30	N300-300HF	30	-	M6	2.5	HBS100N	100A	H¿Mc65
	37	N300-370HF	38	-	M6	2.5	HBS225N	100A	H¿Mc80
	45	N300-450HF	50	-	M8	6.0	HBS225N	150A	H¿Mc110
	55	N300-550HF	60	-	M8	6.0	HBS225N	175A	H¿Mc130
	75	N300-750HF	100 (38×2)	-	M10	10.0	HBS400N	225A	H¿Mc180
	90	N300-900HF	125 (50×2)	-	M10	10.0	HBS400N	225A	H¿Mc220
	110	N300-1100HF	150 (60×2)	-	M10	10.0	HBS400N	350A	H¿Mc260
	132	N300-1320HF	80×2	-	M10	10.0	HBS400N	350A	H¿Mc300

Chapter 2 Installation and Wiring

5) Connecting power to the control circuit, separating from main power

When the protection circuit of inverter is activated and the electromagnetic contactor on the input supply to the inverter isolates the power supply, the control circuit power supply from the inverter will also switch off and the alarm output signal will not be hold.

The power terminals R0 and T0 are designed to allow a supply to go direct to the control circuit and therefore keep the alarm output signal on.

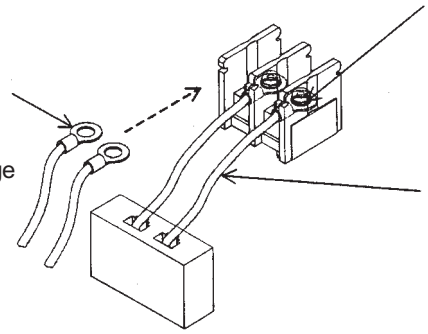
In this case, please connect power terminals R0 and T0, to the primary side of the electromagnetic contactor.

(Inverter unit side of ACL, EMI filter, on using input ACL, EMI filter).

(Connection)

[1] Remove the wires connected.

[3] Connect power supply for control circuit power terminals.



[2] Take off the wire of J51

The specification of the receiving voltage

200～240V ±10%(50/60Hz±5%)
(DC 282～339V)

380～480V ±10%(50/60Hz±5%)
(DC 537～678V)

When you wire the control circuit power source (R0-T0) and the main circuit power source (R, S, T) separately. Please connect the 3A fuse to the power source electric wire, which is for the control circuit.

Chapter 2 Installation and Wiring

2.2.3 Terminal connection diagram

(1) Wiring

1. Both the CM1 and L terminal is insulated to both the common terminal of the input and output signals.
   Do not short or earth these common terminals.

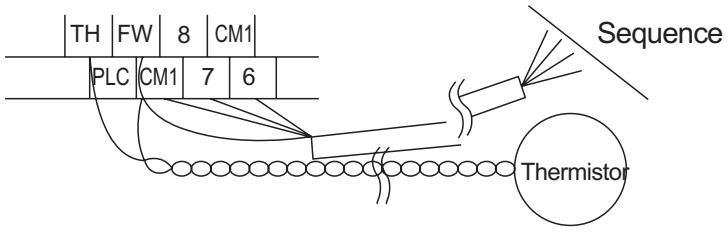
2. Use twisted screened cable, for the input and output wires of the control circuit terminals. Connect the screen to the common terminal.

3. Limit connection wires to 20m. When it is necessary to wire over 20m, use a VX applied controller RCD-A (Remoter operation bar) or a CVD-E (Insulated signal transducer)

4. Separate the control circuit wiring from the main power and relay control wiring.

5. If control and power wires must cross make sure they cross at 90 degrees to each other.

6. When connecting a thermistor to the TH and CM1 terminal, twist the thermistor cables separate from the rests. Limit connection wires to 20m.



7. When using relays for the FW terminal or an intelligent input terminal use a control relay as they are designed to work with 24Vdc.

8. When the relay is used as an intelligent output, connect a diode for surge protection parallel to the coil.

9. Do not short the analogue voltage terminals H and L or the internal power terminals PV24 and CM1. There is risk of Inverter damage.

(2) Layout of control circuit terminals

H	O2	AM	FM	TH	FW	8 (RV)	CM1	5 (2CH)	3 (JG)	1 (RS)	14 (OTQ)	13 (OL)	11 (FA1)	AL1
L	O	OI	AMI	P24	PLC	CM1	7 (CF1)	6 (CF2)	4 (FRS)	2 (AT)	15 (IP)	CM2	12 (RUN)	AL0	AL2

The terminal screw size : M3

Chapter 2 Installation and Wiring

(3) Change of input logic type

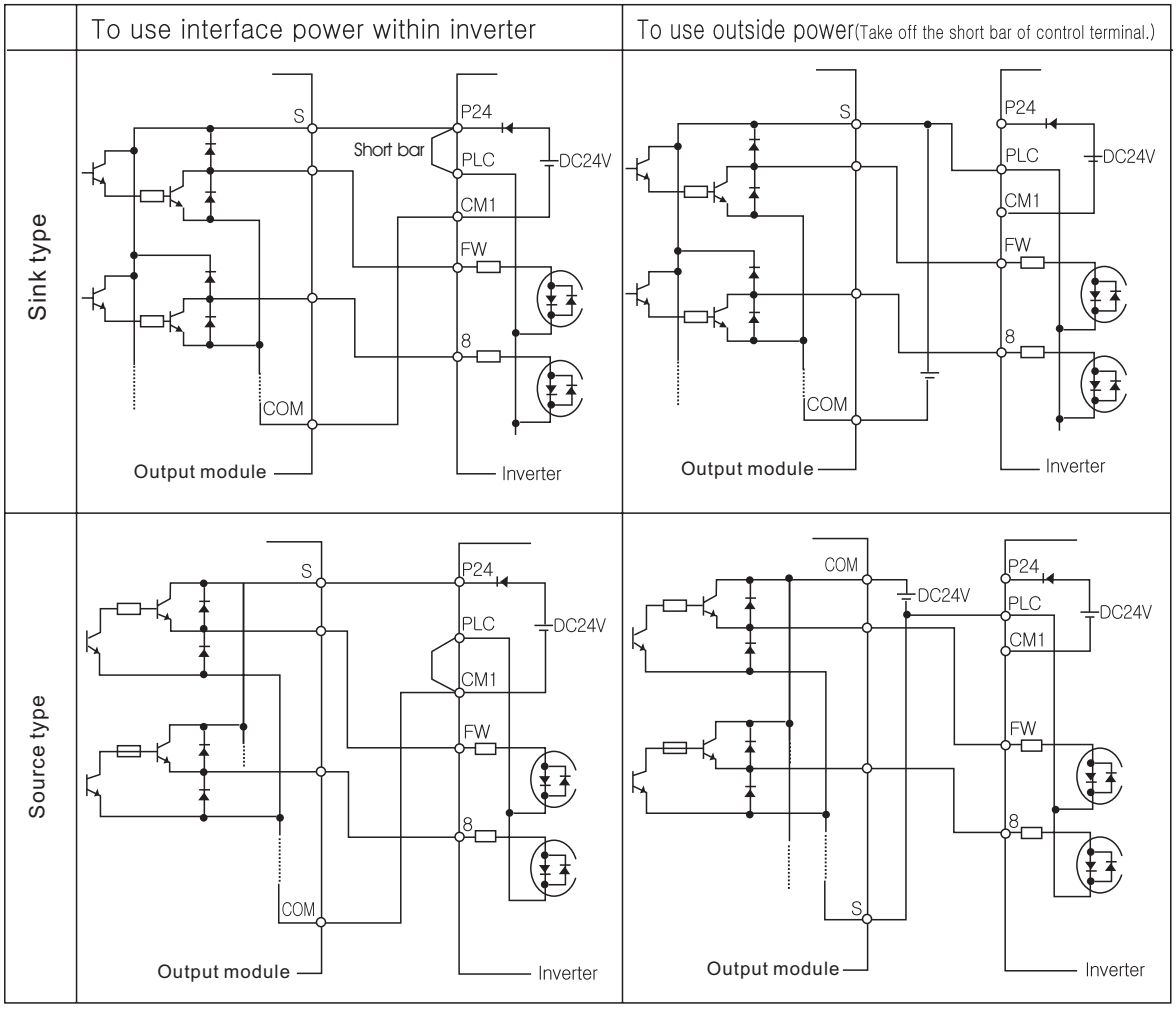
The logic type of intelligent input terminals is written following list (Factory Default).

N300-XXXLF/HF	Sink type

The input logic type can be changed by changing the Short bar connection of control terminal.

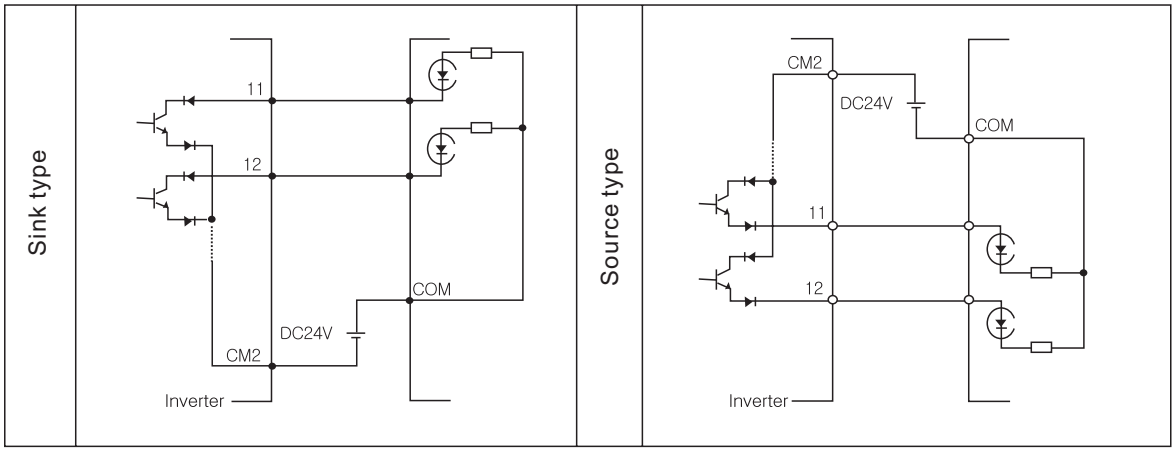
Sink type	Between P24 and PLC on the control terminal.
Source type	Between PLC and Cm1on the control terminal.

(4) The connection to the input programmable logic controller (sequencer)



Chapter 2 Installation and Wiring

(5) The connection to the output programmable logic controller(sequency)



2.2.4 Digital operator wiring

For operating this inverter, it can use digital operator OPE- SR, OPE-SRE, OPE-S, SRW-0J and SRW-0EX.For remote operating, put off digital operator from inverter and use connector cable NOP-1A(1.5m) or NOP-3A(3m).

(Note 1) When using connector cable, be sure to use less than 3m length.
Otherwise, there is a danger of malfunction.
(Note 2) In case of remote operating with connector cable, the inverter dose not conform to EMC.

Chapter 3 Operation

WARNING

- Be sure not to touch the main terminal or to check the signal or put on/off wire and/or connector. Otherwise, there is a danger of electric shock.

- Be sure to turn on the input power supply after closing from cover. While being energized, be sure not to open the front cover. Otherwise, there is a danger of electric shock.

- Be sure not to operate the switches with wet hands. Otherwise, there is a danger of electric shock.

- While the inverter is energized, be sure not to touch the inverter terminals even during stoppage. Otherwise, there is a danger of electric shock.

- If the retry mode is selected, it may suddenly restart during the trip stop. Be sure not to approach the machine.(Be sure to design the machine so that personnel safety will be secured even if it restarts.) Otherwise, there is a danger of injury.

- Be sure not to select retry mode for up and down equipment or traveling equipment, because there is output free-running mode in term of retry. Otherwise, there is a danger of injury and/or machine breakage

- Even if the power supply is cut for a short period of time, it may restart operation after the power supply is recovered if the operation command is given. If it may incur danger to personnel, be suer to make a circuit so that it will not restart after power recovery. Otherwise, there is a danger of injury.

- The stop key is effective only when the function is set. Be sure to prepare the key separately from the emergency stop. Otherwise, there is a danger of injury.

- After the operation command is given, if the alarm reset is conducted, it will restart suddenly. Be sure to set the alarm reset after checking the operation command is off. Otherwise, there is a danger of injury.

- Be sure not to touch the inside of the energized inverter or to put a bar into it. Otherwise, there is a danger of electric shock and/or fire.

Chapter 3 Operation

CAUTION

- Cooling fin will have high temperature. Be sure not to touch them.
  Otherwise, there is a danger of getting burned.

- Low to high speed operation of the inverter can be easily set. Be sure to operate it after checking the tolerance of the motor and machine.
  Otherwise, there is a danger of injury.

- Install external break system if needed.
  Otherwise, there is a danger of injury.

- If a motor is operated at a frequency higher than standard setting value(50Hz / 60Hz), be sure to check the speeds of the motor and the machine with each manufacturer, and after getting their consent, operate them.
  Otherwise, there is a danger of machine breakage.

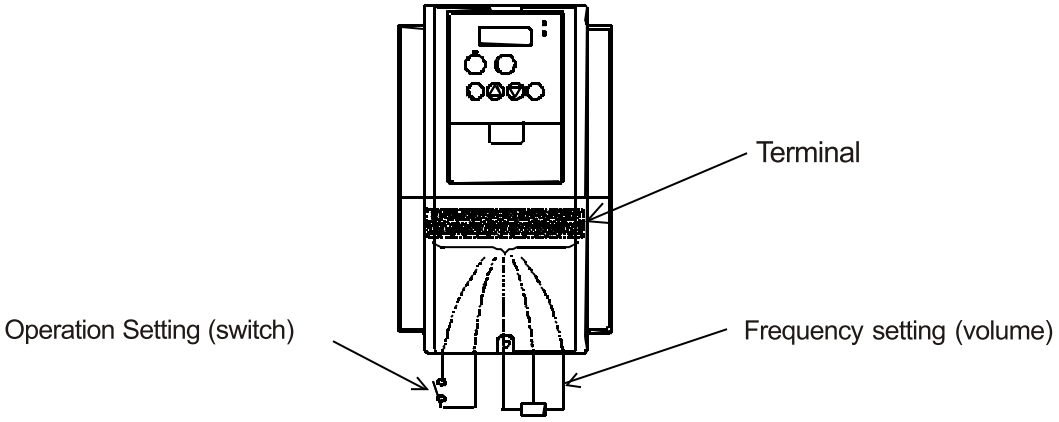
- Check the following before and during the test run.
  Otherwise, there is a danger of machine breakage.
  Was the direction of motor correct?
  Was the inverter tripped during acceleration or deceleration?
  Were the rpm and frequency meter correct?
  Were there any abnormal motor vibrations or noise?

Chapter 3 Operation

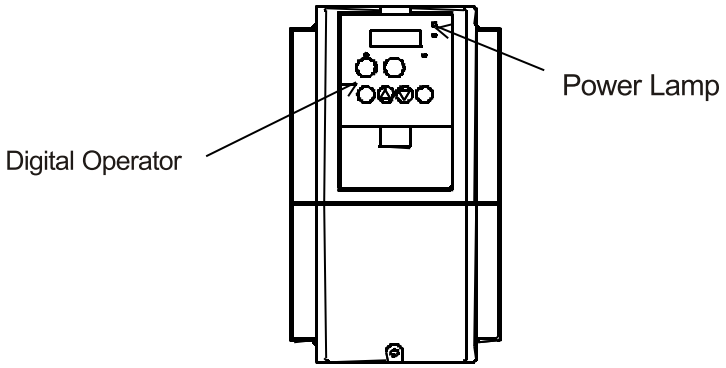
3.1 Operation

This inverter requires two different signals in order for the inverter to operate correctly. The inverter requires both an operation setting and a frequency setting.
The following indicates the details of each method of operation and necessary instructions for operation.

(1) Operation setting and a frequency setting by the terminal control.
This is the method by connecting signals from the outside (the frequency setting, the starting switch etc.) With the control circuit terminals.
The operation is started when the operation setting (FW, RV) is turned ON while the input power is turned ON.
(Note) The methods of the setting frequency with terminal are the voltage setting and the electric setting.
And they are selective by each system. The control circuit terminal list shows this in detail.
(Necessary things for operation)
[1] The operation setting : switch, relay. etc.
[2] The frequency setting: signals from volume or external (DC0～10V, DC-10～10V, 4～20mA etc.)



(2) Operation setting and frequency setting with the digital operator.
This is the method for operation from the digital operator, which comes equipped with the inverter as standard, or the remote operator (SRW) keypad.
When the digital operator sets the operation, the terminals (FW, RV) don't need to be linked.
And it is possible to select frequency from the digital operator as a method of the frequency setting too. (necessary things for operation)
[1] Remote Operator (SRW) (It's unnecessary in case of digital operator operation)



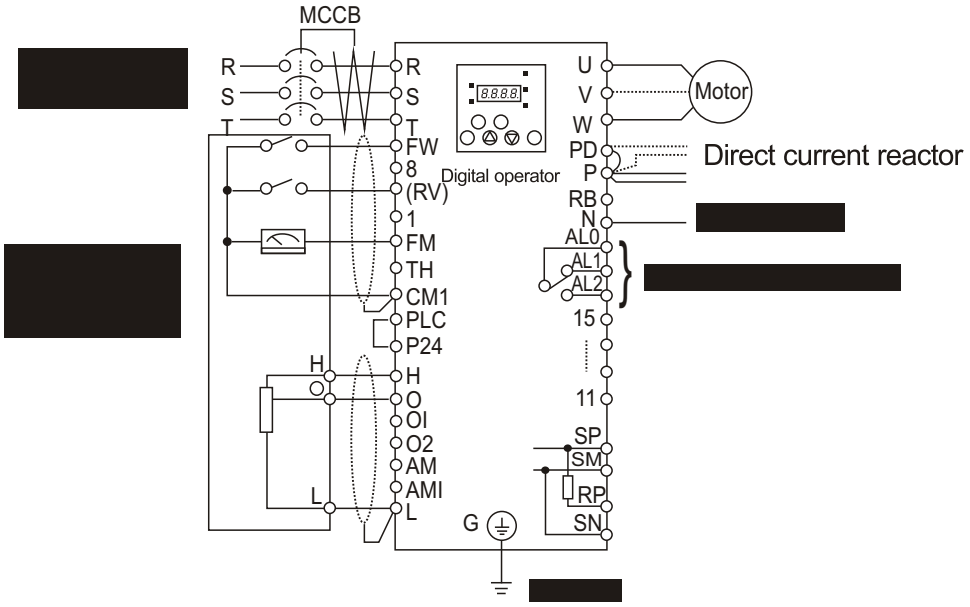
(3) Operation setting and frequency setting from both digital operator and terminal operator
This is the method of inverter operating from both of the above two operating methods
It is possible that the operation setting and the frequency setting can be selected for both the digital operator and the terminal operator each separately.

Chapter 3 Operation

3.2 Test RUN

This is the common connection example. Please refer to 4.1DigitaOperator, for the detailed use of the digital operator (OPE-S).

(1) To input the operation setting and the frequency setting from terminal control.



(Arrangements

[1] Please make sure that the connections are correctly secure.

[2] Turn the MCCB ON to supply power to the inverter.

(The red LED "POWER "on the digita operator should illuminate.)

[3] Set terminal with the frequency setting selection.

Set A001 as indication code, press the FUNC key once. (Two figures are shown.)

Set 01 with the ∧1 key or the ∨2 key, press the STR key once to set the frequency setting for terminal. (Indication code turns back to A001.)

[4] Set terminal with the operation setting selection.

Set A002 as indication code, press the FUNC key once. (Two figures are shown.)

Set 01 with the ∧1 key or the ∨2 key, press the STR key once to set the operation setting for terminal. (Indication code turns back to A002.)

[5] Set monitor mode.

When monitoring the output frequency, set indication code to d001, and press the FUNC key onc

Or when monitoring the operating direction, set indication code to d003, press the FUNC key onc

[6] Input starting operation setting.

Turn ON between [FW] and [CM1] of terminal.

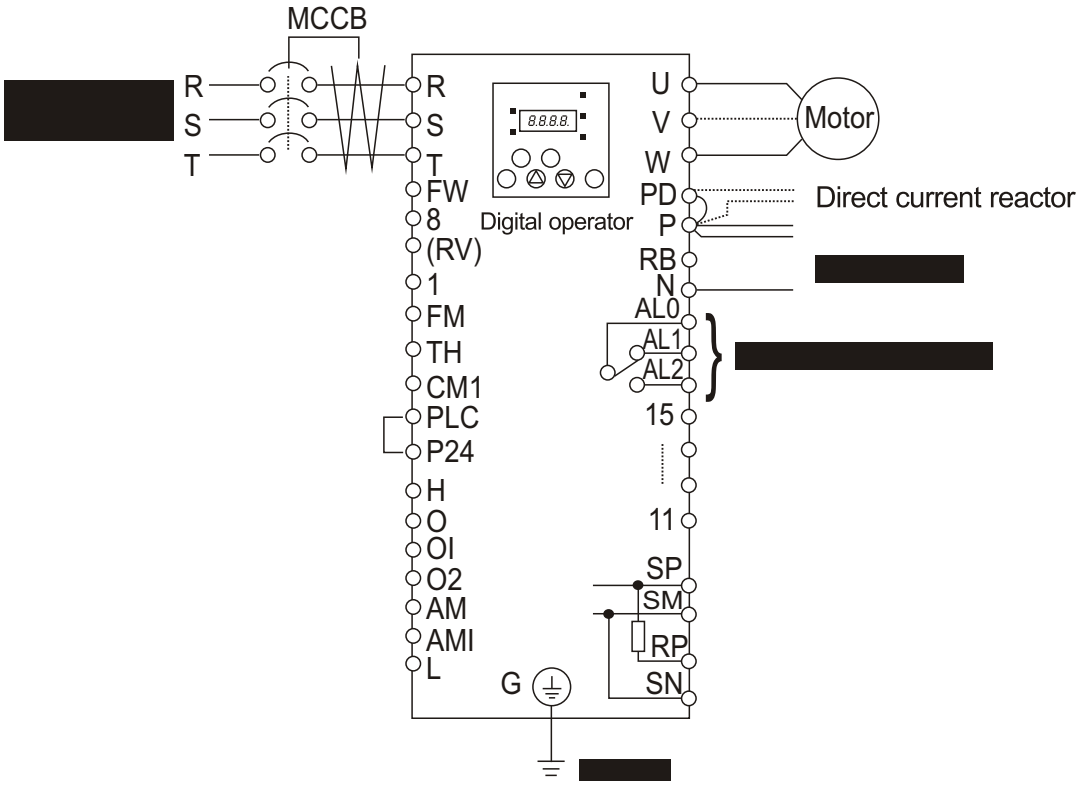
Impress voltage between [O] AND [L] of terminal to start operation.

[7] Input ending operation setting.

Turn OFF between [FW] and [CM1] to stop slowly down.

Chapter 3 Operation

(2) Operation setting and the frequency setting from the digital operator
(Remote operator (SRW) is also same use.)



(Arrangements

[1] Please make sure that there isn't matter about the connection

Chapter 3 Operation

[5] Set the output frequency

Set F001 as indication code, as press the [■] key once.
(Indication code of four is shown.)

Set to the desired output frequency with the [1] key or the [▽] key, press the [■] key once to store it.
(Indication code turns back to F001.)

[6] Set the operation direction.

Set F004 as indication code, press the [FUNC] key once.
(00 or 01 is shown.)

Set operation direction to 00 in case of forward, or to 01 in case of reverse with the [△] key or the [▽] key. Press the [■] key once to establish it.
(Indication code turns back to F004.)

[7] Set Monitor mode.

When monitoring the output frequency, set indication code to d001, and press the [■] key once.
Or when monitoring the operation direction, set indication code to d003, press the [■] key once.

(Indication code are forward, reverse or stop.)

[8] Press the [RUN] key to start operating.
(The green LED " RUN " turns on a light, and the indication changes in response to the monitor mode set.

[9] Press the [STOP/ RESET] key to decelerate to a stop.
(When the frequency turn back to 0, the green LED " RUN" light will switch off.)

CAUTION

[redacted]

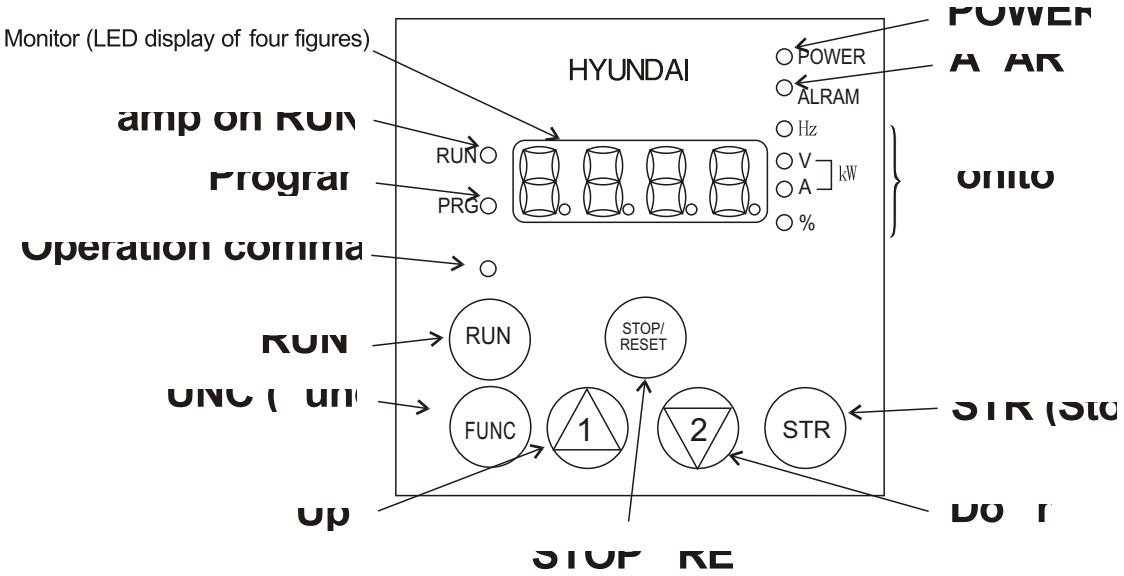
[redacted]

Chapter 4 Explanation of function

4.1 About Digital Operator (OPE-S)

Explanation of operating the digital operator (OPE-S)
N300 series operates by using the digital operator, which is fitted as standard.

1. Name and contents of each part of the digital operator



Name	Content
onito	Displa of fre uenc output current and alue
amp on RU (Operation)	ight on hen the in erter is runni
Program lam	ight on hen displa ing alue of each function in monitor sec ight ill flash On and Off as a arning (hen set alue incorrect
POWER lam	Po er lamp of control circu
A AR lam	ight on hen the in erter tri
onitor lam	amp displa state of monitor section re uenc oltage A Current W Electric po er Rate
Operation comma Displa lamp	ight on onl he operating command (RUN STOP) is set operat
RUN e	Run command to start the motor. ut this is on alid hen operat command is from the operator. (e sure that the operation comman displa lamp is illuminated.)
STOP (STOP RESET) e	This e is used to stop motor or reset alarm
UNC (uncation)	The e containing monitor mode basic setting mode extension functi mode.
STR (Store) e	The e to store the data set.(On changing set alue must be pushed alue is lost.)
UP DOWN e	The e s to change extension function mode function mode and

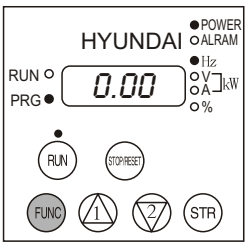
Chapter 4 Explanation of function

2. Operating method

(1) Method to display monitor mode, basic setting mode, extension function mode

Power ON

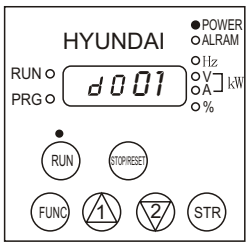
① Display of monitor contents set
(Display 0.00 in initial state)



・When power is turned off while the basic setting mode or the extension setting mode is displayed. The display will be different from the one above when the power is restored.

Push the FUNC key.

⑤ Display monitor code No.
(Display d001)

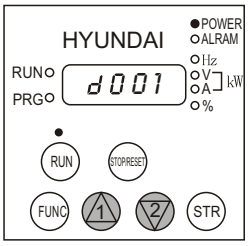


Return to the state of ②

Push the key.1 (6 times)

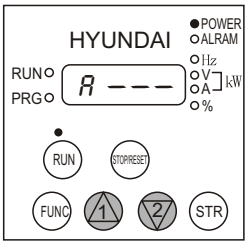
Push the key.2 (6 times)

② Display monitor code No.
(Display d001)



・Monitor mode is displayed by pushing FUNC (Function) key once when display of Monitor mode No.

④ Display extension function mode
(Display A - - -)

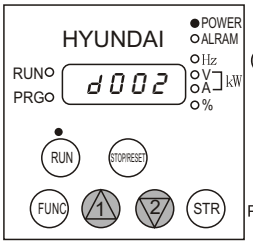


・Extension function mode
Display in the order of
A ↔ B ↔ C ↔ H ↔ P ↔ U

Push the key.2 Push the key.1

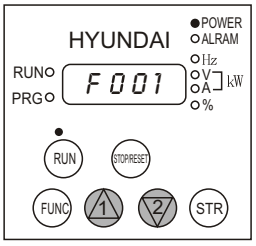
Push the key.1 (8 times) Push the key.2 (8 times)

(Display d002)



*1)
Push the key.1 (19times0
Push the key.2 (19 times)

③ Display code No. of basic setting mode.
(Display F001)

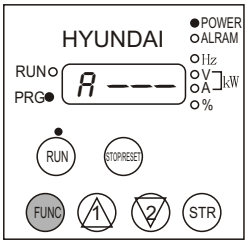


Note) Refer to (3) setting method of function code.

Chapter 4 Explanation of function

(2) Setting method of function
Change operation command part. (Operator → Control terminal)

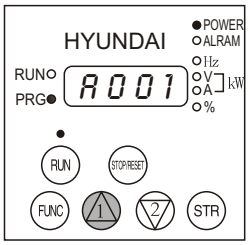
① Display extension function mode



Make monitor display "A - - -" by referring to (1) displaying method.
Now operating command part is by the operator, so operating command display lamp should illuminate.

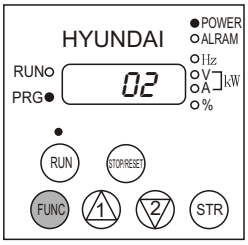
Push the FUNC key.

② Display code No. of function mode



Push the 1 key.

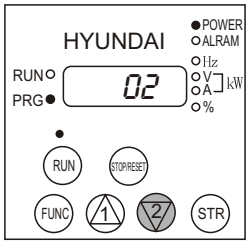
(Display A002)



Push the FUNC key.

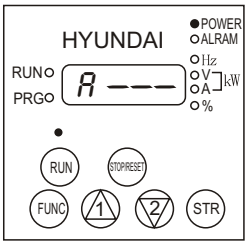
Push the 2 key.

③ Display contents of function mode



Operation command part displays 02(operator).
Program(PRG) light on by displaying contents of function mode.

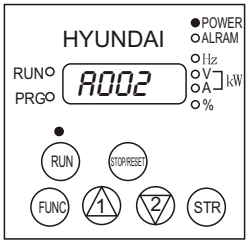
⑤ Display extension function mode (Display A - - -)



It is possible to shift to other extension function modes, monitor modes and basic modes in this state.

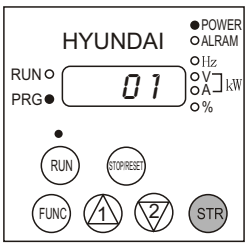
Push the FUNC key.

④ Display code No. of monitor mode. (Display A002)



The changed set value is confirmed by pushing the STR key.
Operation command display lamplight will switch off so that operation command is now changed to the control terminal.

Push the STR key.



Change operation command part to control terminal 01.

Chapter 4 Explanation of function

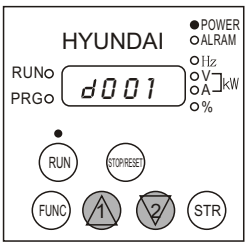
(3) Setting method of function code

Code No. of monitor modes, basic setting modes and extension function codes can be set easily.

Indicate the method to change code No. d001 of monitor mode to function code No..

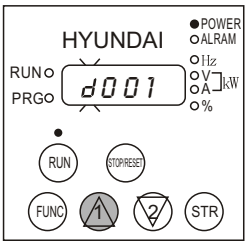
A029 simply.

① Disply code No. of monitor mode.
(Display d001)



Push the 1 2 key together

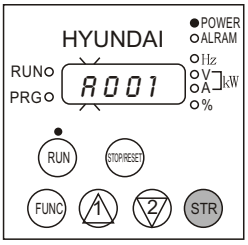
② Change extension function mode



• "d" blinks.

Push the 1 key.
(2 times)

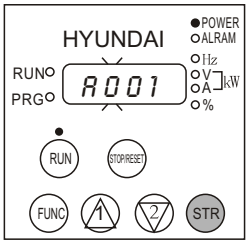
(Display A001)



"A" blinks.
The figure lighting is decided by pushing STR key.

Push the STR key.
(Confirm"A")

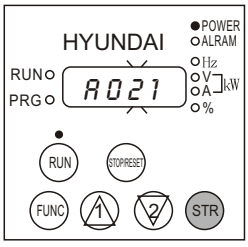
③ Change third figure of function code No..



Third figure "0" blinks.
Don't change third figure and push the STR key and confirm 0.

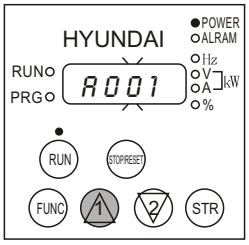
Push the 1 key.
(2 time)

(Display A021)



Second figures, "2" blinks.

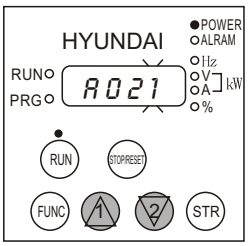
④ Change second figure of function code No..



Second figure "2" blinks.

Push the STR key.
(Confirm "0")

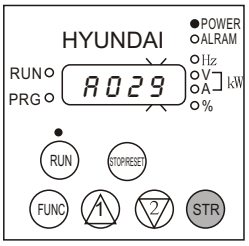
⑤ Change first figure of function code No..



First figure,"1" blinks.

Push the 2 or 1 key.
(2time) (9time)

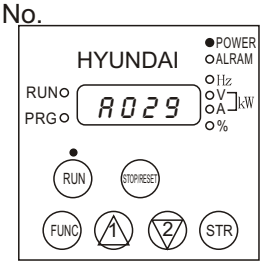
(Display A029)



"9" of first figure blink

Push the STR key.
(Decide "9")

⑥ Finish setting function code No.



• Finish setting A029

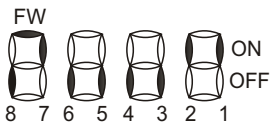
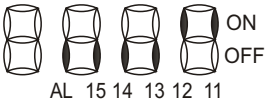
(Note) When you input code No. there isn't in the code list,"A" of left end blinks again. Confirm code No. and input it again.

Chapter 4 Explanation of function

4.2 Code list

Monitor Mode

(Note1)

Display code	Function name	N300 monitor or data range (digital operator)	Initial data	Setting on running	Change mode during running	Page
d001	Output frequency monitor	0.00～99.99/100.0～400.0(Hz)	—	—	—	4-13
d002	Output current monitor	0.0～999.9(A)	—	—	—	4-13
d003	Operator direction monitor	F(forward) / O(stop)/r(reverse)	—	—	—	4-13
d004	PID feedback monitor	0.00～99.99/100.0～999.9/1000.～9999./1000～9999/{100～{999(10000～99900)	—	—	—	4-13
d005	Intelligent input terminal monitor	 (Example) FW, terminal 7, 2, 1:ON Terminal 8, 6, 5, 4, 3:OFF	—	—	—	4-14
d006	Intelligent output terminal monitor	 (Example) Terminal 12, 11 : ON AL,15, 14, 13 : OFF	—	—	—	4-14
d007	Frequency conversion monitor	0.00～99.99/100.0～999.9/1000.～9999./1000～3996	—	—	—	4-15
d012	torque monitor	-300.～+300.%	—	—	—	4-15
d013	Output voltage monitor	0.0～600.0 V	—	—	—	4-15
d014	Input electric power monitor	0.0～999.9 Kw	—	—	—	4-15
d016	Accumulated time monitor during RUN	0.9999./1000～9999/{100～{999 hr	—	—	—	4-16
d017	Power ON time monitor	0.～9999./1000～9999/{100～{999 hr	—	—	—	4-16
d080	Number of trip time monitor	0.～9999./1000～6563(10000～65530) (times)	—	—	—	4-16
d081	Trip monitor 1	TripCode, frequency(Hz), current(A), voltage(V), RUN time(hr), power ON time(hr)	—	—	—	4-16
d082	Trip monitor 2		—	—	—	4-16
d083	Trip monitor 3		—	—	—	4-16
d084	Trip monitor 4		—	—	—	4-16
d085	Trip monitor 5		—	—	—	4-16
d086	Trip monitor 6		—	—	—	4-16
d090	Warning monitor	Warning code	—	—	—	4-100
F001	Output frequency setting	0.0, starting frequency-Max.frequency (2^{nd} max, 3^{rd} max. frequency) (Hz)	0.00	○	○	4-17
F002	1^{st} acceleration time	0.01～99.99/100.0～999.9/1000～3600.(S)	30.00	○	○	4-19
F202	2^{nd} acceleration time	0.01～99.99/100.0～999.9/1000～3600.(S)	30.00	○	○	4-19
F302	3^{rd} acceleration time	0.01～99.99/100.0～999.9/1000.～3600.(S)	30.00	○	○	4-19
F003	1^{st} deceleration time	0.01～99.99/100.0～999.9/1000.～3600.(S)	30.00	○	○	4-19
F203	2^{nd} deceleration time	0.01～99.99/100.0～999.9/1000.～3600.(S)	30.00	○	○	4-19
F303	3^{rd} deceleration time	0.01～99.99/100.0～999.9/1000.～3600.(S)	30.00	○	○	4-19
F004	Operation direction selection	00(forward) / 01(reverse)	00	×	×	4-17

(Note1) Change mode during run by selection of b031(software lock selection).

(Note) Do not forget to press "STR" key when you change the display.

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Base setting	A001	Frequency setting selection	00(VR)/01(terminal)/02(operator)/03(RS485)/ 04(option1)/05(option2)	02	X	X	4-17
	A002	Operation setting selection	01(terminal)/02(operator)/03(RS485)/04(option1)/ 05(option2)	02	X	X	4-18
	A003	Base Frequency	30.～Maximum. Frequency (Hz)	60.	X	X	4-20
	A203	Base Frequency, 2nd motor	30.～2ndMaximum. Frequency (Hz)	60.	X	X	4-20
	A303	Base Frequency, 3rd motor	30.～3rdMaximum. Frequency (Hz)	60.	X	X	4-20
	A004	Maximum Frequency	30. ～400. (Hz)	60.	X	X	4-21
	A204	Maximum Frequency, 2nd motor	30. ～400. (Hz)	60.	X	X	4-21
	A304	Maximum Frequency, 3rd motor	30. ～400. (Hz)	60.	X	X	4-21
Analog input setting	A005	AT terminal selection	00(Changing of O and OI with AT terminal)/ 01(Changing of O and OI with AT terminal)	00	X	X	4-22
	A006	02 selection	00(single)/01(auxiliary speed of O, OI)[no reversible] /02(auxiliary speed of O, OI)[reversible]	00	X	X	4-22
	A011	0 start	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-23
	A012	0 end	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-23
	A013	0 start rate	0～100.0(%)	0.	X	○	4-23
	A014	0 end rate	0～100.0(%)	100.	X	○	4-23
	A015	0 start selection	00(extermal starting frequency)/01(0Hz)	01	X	○	4-23
	A016	O,OI,O2 sampling	1.～30.(times)	8.	X	○	4-24
Multistage speed. Jogging frequency setting	A019	Multi - speed selection	00(binary : range is to 16 stage speed with 4 terminals)/ 01(bit : range is to 8 stage speed with 7 terminals)	00	X	X	4-46
	A020	Multi - speed 0	0.00, srarting frequency ～ maximum. frequency(Hz)	0.00	○	○	4-46
	A220	Multi - speed 0, 2nd motor	0.00, starting frequency ～ 2nd maximum. Frequency(Hz)	0.00	○	○	4-46
	A320	Multi - speed 0, 3rd motor	0.00, starting frequency ～ 3rd maximum. Frequency(Hz)	0.00	○	○	4-46
	A021	Multi - speed 1	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A022	Multi - speed 2	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A023	Multi - speed 3	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A024	Multi - speed 4	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A025	Multi - speed 5	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A026	Multi - speed 6	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46
	A027	Multi - speed 7	0.00, starting frequency ～ maximum. Frequency(Hz)	0.00	○	○	4-46

Note1) Valid for tve connection of OPE-SR

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Multistage speed. Jogging frequency setting	A028	Multi - speed 8	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A029	Multi - speed 9	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A030	Multi - speed 10	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A031	Multi - speed 11	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A032	Multi - speed 12	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A033	Multi - speed 13	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A034	Multi - speed 14	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A035	Multi - speed 15	0.00, starting frequency ~ maximum. Frequency(Hz)	0.00	○	○	4-46
	A038	Jogging frequency	0.00, srarting frequency ~ 9.99(Hz)	1.00	○	○	4-48
	A039	Jogging selection	00(free-run on JG stop/invalid on running)/01(stop decelerating on JG stop/invalid on running)/02(DC braking on JG stop/invalid on runnin g)/03(free-run on JG stop/valid on running[JG after stop decelerating])/ 04(stop decelerating on JG stop/valid on running)/ 05(DC braking on JG stop/valid on operating)	00	X	○	4-48
V/fCharateristic	A041	Torque boost selection	00(manual torque boost)/01(automatic torque boost)	00	X	X	4-27
	A241	Torque boost selection, 2nd motor	00(manual torque boost)/01(automatic torque boost)	00	X	X	4-27
	A042	Manual torque boost	0.0~20.0(%)	1.0	○	○	4-27
	A242	Manual torque boost, 2nd motor	0.0~20.0(%)	1.0	○	○	4-27
	A342	Manual torque boost, 3rd motor	0.0~20.0(%)	1.0	○	○	4-27
	A043	Manual torque boost point	0.0~50.0(%)	5.0	○	○	4-27
	A243	Manual torque boost point, 2nd motor	0.0~50.0(%)	5.0	○	○	4-27
	A343	Manual torque boost point, 3rd motor	0.0~50.0(%)	5.0	○	○	4-27
	A044	1st control	00(VC)/01(VP1.7power)/02(free V/f setting)/03(SLV)/ 04(0Hz-SLV)/05(V2)	00	X	X	4-25
	A244	2st control	00(VC)/01(VP1.7power)/02(free V/f setting)/03(SLV)/ 04(0Hz-SLV)	00	X	X	4-25
	A344	3st control	00(VC)/01(VP1.7power)	00	X	X	4-25
	A045	Output voltage gain	20.~100.	100.	○	○	4-24
Direct current braking	A051	DC braking selection	00(invalid)/01(valid)	00	X	○	4-28
	A052	DC braking frequency	0.00~60.00(Hz)	0.50	X	○	4-28
	A053	DC braking wait time	0.0~5.0(S)	0.0	X	○	4-28
	A054	DC braking power	0.~100.(%)	0.	X	○	4-28
	A055	DC braking time	0.0~60.0(S)	0.0	X	○	4-28
	A056	DC braking edge/ievel selection	00(edge action)/01(level action)	01	X	○	4-28
	A057	DC braking power(starting time)	0.~100.(%) < 0~80(%)	0.	X	○	4-28
	A058	DC braking time(starting time)	0.00~60.0(S)	0.0	X	○	4-28
	A059	DC carrier frequency	0.5~15(kHz) Derating <0.5~10kHz>	5.0<3.0>	X	X	4-28

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Upper and lower limiter jumpfequency	A061	1st frequency maximum limiter	0.00,1st frequency lower limiter-maximum frequency(Hz)	0.00	X	○	4-31
	A261	2st frequency maximum limiter	0.00,2st frequency lower limiter-2nd setting maximum frequency(Hz)	0.00	X	○	4-31
	A062	1st frequency maximum limiter	0.00, start frequency-1st frequency maximum limiter(Hz)	0.00	X	○	4-31
	A262	2st frequency maximum limiter	0.00, start frequency-2nd frequency maximum limiter(Hz)	0.00	X	○	4-31
	A063	Jump frequency 1	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-32
	A064	Jump frequency width 1	0.00～10.00(Hz)	0.50	X	○	4-32
	A065	Jump frequency 2	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-32
	A066	Jump frequency width 2	0.00～10.00(Hz)	0.50	X	○	4-32
	A067	Jump frequency 3	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-32
	A068	Jump frequency width 3	0.00～10.00(Hz)	0.50	X	○	4-32
	A069	Acceleration stop frequency	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-32
	A070	Acceleration stop time	0.00～60.0(s)	0.0	X	○	4-32
PIDControl	A071	PID selection	00(invalid)/01(valid)	00	X	○	4-33
	A072	PID-P gain	0.2～5.0	1.0	○	○	4-33
	A073	PID-I gain	0.～3600.(s)	1.0	○	○	4-33
	A074	PID-D gain	0.00～100.0(s)	0.00	○	○	4-33
	A075	PID scale	0.01～99.99(%)	1.00	X	○	4-33
	A076	PID feedback selection	00(feedback:OI)/01(feedback:O)	00	X	○	4-33
AVR	A081	AVR selection	00(ON always)/01(OFF always)/02(OFF on decelerating)	02	X	X	4-20
	A082	Motor voltage selection	200/215/550/230/240/, 380/400/415440/460/480	220/440	X	X	4-20
Operationmode. Adjustable function	A085	Operation mode selection	00(normal operation)/01(energy-saving operation)/ 02(fuzzy)	00	X	X	4-34
	A086	Energy-saving response-accuracy adjustment	0.0～100.0	50.0	○	○	4-34
	A092	Acceleration time 2	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A292	Acceleration time 2 (2nd motor)	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A392	Acceleration time 2 (3rd motor)	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A093	Deceleration time 2	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A293	Deceleration time 2 (2nd motor)	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A393	Deceleration time 2 (3rd motor)	0.0～99.99/100.0～999.9/1000.～3600.(s)	15.00	○	○	4-35
	A094	2nd stage adjustable selection	00(change with 2CH terminal)/01(change with setting)	00	X	X	4-35
	A294	2nd stage adjustable selection(2nd motor)	00(change with 2CH terminal)/01(change with setting)	00	X	X	4-35
	A095	2nd Acceleration frequency	0.00～99.99/100.0～400.0(Hz)	0.00	X	X	4-35

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Operationmode. Adjustable function	A295	2nd Acceleration frequency(2nd motor)	0.00～99.99/100.0-400.0(Hz)	0.00	X	X	4-35
	A096	2nd deceleration frequency	0.00-99.99/100.0～400.0(Hz)	0.00	X	X	4-35
	A296	2nd deceleration frequency(2nd motor)	0.00～99.99/100.0～400.0(Hz)	0.00	X	X	4-35
	A097	Acceleration pattern selection	0(straight line)/01(S-curve)/02(U-curve)/ 03(reverse U-curve)	00	X	X	4-36
	A098	Deceleration pattern selection	00(straight line)/01(S-curve)/02(U-curve)/ 03(reverse U-curve)	00	X	X	4-36
External frequency adjustment	A101	OI start	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-23
	A102	OI end	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-23
	A103	OI start rate	0.～100.(%)	20.	X	○	4-23
	A104	OI end rate	0.～100.(%)	100.	X	○	4-23
	A105	OI start selection	start frequency)/01(0Hz)	01	X	○	4-23
	A111	O2 srart	-400.～100./-99.9～0.00～99.99/10000 (external .0～400.0(Hz)	0.00	X	○	4-23
	A112	O2 end	-400.～100./-99.9～0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-23
	A113	O2 start rate	-100.～100(%)	-100	X	○	4-23
	A114	O2 end rate	-100.～100(%)	100.	X	○	4-23
Accel. Decel.	A131	Acceleration curve constant	01(small swelling)～10(large swelling)	02	X	○	4-36
	A132	Deceleration curve constant	01(small swelling)～10(large swelling)	02	X	○	4-36
Instantaneous power failure restart	b001	Retry selection	00(trip)/01(0Hz start)/02(start after equal frequency)/ 03(trip after equaling frequency and deceleration stop)	00	X	○	4-37
	b002	Allow under-voltage power failure time	0.3～1.0(s)	1.0	X	○	4-37
	b003	Retry wait time	0.3～100.(s)	1.0	X	○	4-37
	b004	Instantaneous power failure/under voltage trip during stop	00(invalid)/01(valid)/02(invalid during stop and deceleration by stop command)	00	X	○	4-37
	b005	Instantaneous power failure/under voltage retry time selection	00(16 times)/01(free)	00	X	○	4-37
	b006	Open-phase selection	00(invalid)/01(valid)	00	X	○	4-38
	b007	Frequency setting match	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-37
Electronic thermal	b012	Electronic thermal level	0.2*constant current～1.20*constant current(A)	Rated current inverter	X	○	4-39
	b212	Electronic thermal level (2^{nd} motor)	0.2*constant current～1.20*constant current(A)	Rated current inverter	X	○	4-39
	b312	Electronic thermal level (3^{rd} motor)	0.2*constant current～1.20*constant current(A)	Rated current inverter	X	○	4-39
	b013	1^{st} electronic thermal characteristic selection	00(reduced characteristic)/01(constant torque characteristic)/02(free setting)	01	X	○	4-39
	b213	2^{nd} electronic thermal characteristic selection	00(reduced characteristic)/01(constant torque characteristic)/02(free setting)	01	X	○	4-39

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Electronic thermal	b313	3rd electronic thermal characteristic selection	00(reduced characteristic)/01(constant torque characteristic)/02(free setting)	01	X	○	4-39
	b015	Free electronic thermal frequency 1	0.～400.(Hz)	0.	X	○	4-40
	b016	Free electronic thermal current 1	0.0～1000.(A)	0.0	X	○	4-40
	b017	Free electronic thermal frequency 2	0.～400.(Hz)	0.	X	○	4-40
	b018	Free electronic thermal current 2	0.0～1000.(A)	0.0	X	○	4-40
	b019	Free electronic thermal frequency 3	0.～400.(Hz)	0.	X	○	4-40
	b020	Free electronic hermal current 3	0.0～1000.(A)	0.0	X	○	4-40
Overload limit	b021	Overload restriction selection	00(invalid)/01(enabled on acceleration/constant peed)/02(enabled on constant speed)/03(enabled on acceleration/constant speed[speed increasing at regenerating mode])	01	X	○	4-41
	b022	Overload restriction level	0.50*rated current～2.00*rated current(A)<～1.80* rated current(A)>	Rated current of inverter×1.50	X	○	4-41
	b023	Overload restriction limit constant	0.10～30.00(s)	1.00	X	○	4-41
	b024	Overload restriction 2 selection	00(invalid)/01(enabled on acceleration/constant speed)/02(enabled on constant speed)/03(enabled on acceleration/constant speed[speed increasing at regenerating mode])	01	X	○	4-41
	b025	Overload restriction level 2	0.50*rated current-2.00*rated current(A)<～1.80* rated current(A)>	Rated current of inverter×1.50	X	○	4-41
	b026	Overload restriction constant 2	0.10～30.00(s)	1.00	X	○	4-41
Lock	b031	Software lock mode selection	00(impossible to change the data except this item when SFT terminal is ON)/01(impossible to change the data except setting frequency item when SFT terminal is ON)/02(impossible to change the data except this item)03(impossible to change the data except setting frequency item)/10(possible to change data on operating)	01	X	○	4-50
Other	b034	RUN time/Power ON time level	0.～9999./1000～6563(100000～655300)h	0	X	○	4-61
	b035	Operation direction restrict	00(Reverse is valid)/01(Only forward)/02(Only reverse)	00	X	○	4-17
	b036	Start reduced voltage	00(Start reduced voltage time small)～ 06(Start reduced voltage time large)	06	X	○	4-43
	b037	Display selection	00(all display)/01(each function display)/ 02(User setting/main setting)	00	X	○	4-66
	b040	Torque limit mode selection	00(4 quadrant mode)/01(Terminal operation)/ 02(Analog input)/03(Option 1)/04(Option 2)	00	X	○	4-79
	b041	Torque limit level 1 setting(Forward driving at 4 quadrant mode)	0.～200.(%)/no(Invalid) < 0～180% / no >	150.	X	○	4-79
	b042	Torque limit level 2 setting(Reverse regenerating at 4 quadrant mode)	0.～200.(%)/no(Invalid) < 0～180% / no >	150.	X	○	4-79

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Other	b043	Torque limit level 3 setting(Reverse driving at 4 quadrant mode)	0.～200.(%)/no(Invalid) < 0～180% / no >	150.	X	○	4-79
	b044	Torque limit level 4 setting(Forward regenerating at 4 quadrant mode)	0.～200.(%)/no(Invalid)	150.	X	○	4-79
	b045	Torque LAD-STOP selection	< 0～180% / no > 00(Invalid)/01(Valid)	00	X	○	4-81
	b046	Reverse run prevention selection	00(Invalid)/01(Valid)	00	X	○	—
	b050	Selection of non stop function at instantaneous power failure	00(Invalid)/01(Valid)	00	X	X	4-71
	b051	Start voltage of run non-stop function setting	0.0～1000.(V)	0.0	X	X	4-71
	b052	OV LAD-STOP level of non-stop function setting	0.0～1000.(V)	0.0	X	X	4-71
	b053	Deceleration time of non-stop function setting	0.01-99.99/100.0-999.9/1000.-3600.(S)	1.00	X	X	4-71
	b054	Deceleration frequency width of non-stop function setting	0.00～10.00(Hz)	0.00	X	X	4-71
	b080	AM Adjustment	0.～255.	180	○	○	4-64
	b081	FM Adjustment	0.～255.	60	○	○	4-63
	b082	Start frequency Adjustment	0.10～9.99(Hz)	0.50	X	○	4-43
	b083	Carrier frequency setting	0.5～15.0(kHz) Derationg enable, <0.5～10kHz>	5.0<3.0>	X	X	4-21
	b084	Initialize mode	00(Trip history clear)/01(Data initialization)/ 02(Trip history clear + data initialization)	00	X	X	4-65
	b085	Country code for Initialization	00(Interior)/01(EC)/02(USA)	00	X	X	4-65
	b086	Frequency scalar conversion factor	0.1～99.9	1.0	○	○	4-15
	b087	STOP key enable	00(valid)/01(invalid)	00	X	○	4-18
	b088	Resume on FRS cancellation mode	00(0Hz start)/01(Start -equaling)	00	X	○	4-51
	b090	BRD usage ratio	0.0～100.0(%)	0.0	X	○	4-44
	b091	Stop mode selection	00(deceleration stop)/01(Free-run stop)	00	X	X	4-18
	b092	Cooling fan control	00(Always ON)/01(ON during run, After power ON, then for 5 minutes on stop is implied.)	00	X	X	4-44
	b095	BRD selection	00(invalid)/01(valid<invalid during stop>)/ 02(valid<valid during stop>)	00	X	○	4-44
	b096	BRD ON level	330～380/660～760(V)	360/720	X	○	4-44

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Other	b098	Thermistor selection	00(invalid)/01(PTC)/02(NTC enable)	00	X	○	4-64
	b099	Thermistor error level	0.～9999. (Ohm)	3000.	X	○	4-64
Free V/ F setting	b100	Free V/f frequency 1	0.～Free V/f frequency 2(Hz)	0.	X	X	4-26
	b101	Free V/f voltage 1	0.～800.0(V)	0.0	X	X	4-26
	b102	Free V/f frequency 2	0.～Free V/f frequency 3(Hz)	0.	X	X	4-26
	b103	Free V/f voltage 2	0.～800.0(V)	0.0	X	X	4-26
	b104	Free V/f frequency 3	0.～Free V/f frequency 4(Hz)	0.	X	X	4-26
	b105	Free V/f voltage 3	0.～800.0(V)	0.0	X	X	4-26
	b106	Free V/f frequency 4	0.～Free V/f frequency 5(Hz)	0.	X	X	4-26
	b107	Free V/f voltage 4	0.～800.0(V)	0.0	X	X	4-26
	b108	Free V/f frequency 5	0.～Free V/f frequency 6(Hz)	0.	X	X	4-26
	b109	Free V/f voltage 5	0.～800.0(V)	0.0	X	X	4-26
	b110	Free V/f frequency 6	0.～Free V/f frequency 7(Hz)	0.	X	X	4-26
	b111	Free V/f voltage 6	0.～800.0(V)	0.0	X	X	4-26
	b112	Free V/f frequency 7	0.～400.0(V)	0.	X	X	4-26
	b113	Free V/f voltage 7	0.～800.0(V)	0.0	X	X	4-26
Other	b120	Braking control selection	00(Invalid)/01(valid)	00	X	○	4-69
	b121	Waiting time for releasing braking information	0.00～5.00(S)	0.00	X	○	4-69
	b122	Waiting time for acceleration	0.00～5.00(S)	0.00	X	○	4-69
	b123	Waiting time for stop	0.00～5.00(S)	0.00	X	○	4-69
	b124	Waiting time for signal conformation	0.00～5.00(S)	0.00	X	○	4-69
	b125	Releasing frequency	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-69
	b126	Releasing current	0.00*rated current-2.00*rate current(A)	Inverter rate current	X	○	4-69

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Intelligent input terminal setting	C001	Intelligent input 1 setting	01(RV:Reverse is valid)/02(CF1:Multi-speed 1)/03(CF2: Multi-speed 2)/04(CF3:Multi-speed3)/05(CF4:Multi-speed4)/06(JG Jogging)/07(DB:External DC braking)/08(SET:2nd control)/ 09(2CH: Two-stage adjustable speed)/11(FRS:Free-run)/ 12(EXT:External trip)/13(USP:Unattended start protection)/ 14(CS:Commerical change)/15(SFT:Software lock)/16(AT:Analog input voltage/current select)/17(SET:3rd control)/18(RS:Reset inverter)/ 20(STA:3wire run/ 21(STP:3wire keep)/22(F/R:3wire forward/ reverse)/23(PID:PIDselection valid/invalid)/24(PIDC:PID integrating reset)/26(CAS:Control gain switch function)/27(UP:Remote control UP function)/28(DWN:Remote control DOWN function)/ 29(UDC:Remote control data clear)/31(OPE:Operating by operator select)/32(SF1: Multi-speed bit 1)/33(SF2: Multi-speed bit2)/ 34(SF3: Multi-speed bit3)/35(SF4: Multi-speed bit4)/36(SF5: Multi-speed bit5)/37(SF6: Multi-speed bit6)/38(SF7: Multi-speed bit7)/ 39(OLR:Ovwrload restriction change)/40(TL:Torque limit select)/ 41(TRQ1:Torque limit switch1)/42(TRQ2:Torque limit switch2)/ 43(PPI:P/PIswitch)/44(BOK:Braking comformation)/45(ORT: Orientation)/46(LAC:LAD cancel)/47(PCLR:Position error clear)/ 48(STAT:Permission of pulse train)/no(NO:No assign)	18(RS)	X	○	4-45
	C002	Intelligent input 2 setting		16(AT)	X	○	4-45
	C003	Intelligent input 3 setting		06(JG)	X	○	4-45
	C004	Intelligent input 4 setting		11(FRS)	X	○	4-45
	C005	Intelligent input 5 setting		09(2CH)	X	○	4-45
	C006	Intelligent input 6 setting		03(CF2)	X	○	4-45
	C007	Intelligent input 7 setting		02(CF1)	X	○	4-45
	C008	Intelligent input 8 setting		01(RV)	X	○	4-45
Input terminal setting intelligent	C011	Intelligent input 1 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C012	Intelligent input 2 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C013	Intelligent input 3 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C014	Intelligent input 4 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C015	Intelligent input 5 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C016	Intelligent input 6 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C017	Intelligent input 7 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C018	Intelligent input 8 a/b (NO/NC)) selection	00(NO)/01(NC)	00	X	○	4-46
	C019	FW a/b(NO/NC) selection	00(NO)/01(NC)	00	X	○	4-46
Intelligent output terminal setting	C021	Intelligent output 11 selection	00(RUN: running)/01(FA1:Frequency arrival type1 signal)/ 02(FA2: over setting frequency)/03(OL:Overload advance notice signal)/04(OD: Output deviation for PID control)/ 05(AL:Alarm signal)/06(FA3:Only setting frequency)/ 07(OTQ: Over torque signal)/08(IP: On instantaneous stop)/ 09(UV:Under voltage)/10(TRQ:Torque limit)/11(RNT:RUN time over)/12(ONT:ON time over)/13(THM: thermal caution)/ 19(BRK:Brake release signal)/20(BER: Brake error signal)/ 21(ZS:Zero speed detect signal)/22(DSE:Speed error over signal)/23(POK:Positioning completion signal)/24(FA4:Over frequency 2 signal)/25(FA5:Only setting frequency)/ 26(OL2: Overload advance notice signal 2)/(Intelligent output terminal 11-13 or 11-14 becomes AC0-AC-2 OR AC0-AC-3 (Can : Alarm cord output) forcibly when alarm cord output is selected in C062)	01(FA1)	X	○	4-46
	C022	Intelligent output 12 selection		00(RUN)	X	○	4-57
	C023	Intelligent output 13 selection		03(OL)	X	○	4-57
	C024	Intelligent output 14 selection		07(OTQ)	X	○	4-57
	C025	Intelligent output 15 selection		08(IP)	X	○	4-57
	C026	Alarm relay output		05(AL)	X	○	4-57
	C027	FM selection	00(Output frequency)/01(Output current)/02(Output torque) / 03(Digital output frequency)/04(Output voltage)/05(Input electric power)/06(thermal load rate)/07(LAD frequency)	00	X	○	4-57
	C028	AM selection	00(Output frequency)/01(Output current)/02(Output torque) / 03(Digital output frequency)/04(Output voltage)/05(Input electric power)/06(thermal load rate)/07(LAD frequency)	00	X	○	4-63
	C029	AMI selection	00(Output frequency)/01(Output current)/02(Output torque) / 03(Digital output frequency)/04(Output voltage)/05(Input electric power)/06(thermal load rate)/07(LAD frequency)	00	X	○	4-64

Chapter 4 Explanation of function

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Output terminal state setting output level setting	C031	Intelligent output 11 a/b selection	00(NO)/01(NC)	00	X	○	4-64
	C032	Intelligent output 12 a/b selection	00(NO)/01(NC)	00	X	○	4-58
	C033	Intelligent output 13 a/b selection	00(NO)/01(NC)	00	X	○	4-58
	C034	Intelligent output 14 a/b selection	00(NO)/01(NC)	00	X	○	4-58
	C035	Intelligent output 15 a/b selection	00(NO)/01(NC)	00	X	○	4-58
	C036	Alarm relay output a/b selection	00(NO)/01(NC)	00	X	○	4-58
	C040	Overload advance notice signal output mode	00(On accel. And decel, constant speed)/ 01(Only constant speed)	01	X	○	4-58
	C041	Overload advance notice level	0.0-2.0*rated current(A)	Inverter rated current	X	○	4-42
	C042	Frequency arrival setting for acceleration.	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-42
	C043	Arrival frequency setting for deceleration.	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-59
	C044	PID deviation setting level	0.0～100.0(%)	3.0	X	○	4-59
	C045	Frequency arrival setting for acceleration.2	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-34
	C046	Arrival frequency setting for deceleration.2	0.00～99.99/100.0～400.0(Hz)	0.00	X	○	4-59
	C055	Over torque level setting (Forward driving)	0.0～200.0(%) <0～180>	100.	X	○	4-59
	C056	Over torque level setting (Reverse regenerating)	0.0～200.0(%) <0～180>	100.	X	○	4-62
	C057	Over torque level setting (Reverse driving)	0.0～200.0(%) <0～180>	100.	X	○	4-62
	C058	Over torque level setting (Forward regenerating)	0.0～200.0(%) <0～180>	100.	X	○	4-62
	C061	Thermal warning level setting	0～100.(%)	80.	X	○	4-40
	C062	Alarm code selection	00(Invalid)/01(3bit)/02(4bit)	00	X	○	4-62
	C063	Zero speed detection level setting	0.00～99.99/100.(Hz)	0.00	X	○	4-61
Communication function adjustment	C070	Data command	02(operator)/03(RS485)/04(option1)/05(option2)	02	X	X	4-82
	C071	Communicating transmission speed	02(loop-back test) 03(2400bps)/04(4800bps)/05(9600bps)/06(19200bps)	04	X	○	4-82
	C072	Communication code	1.～32.	1.	X	○	4-82
	C073	Communication bit	7(7bit)/8(8bit)	7	X	○	4-82
	C074	Communication parity	00(no parity name)/01(even parity)/02(odd parity)	00	X	○	4-82
	C075	Communication stop bit	1(bit)/2(bit)	1	X	○	4-82
	C078	Communication waiting time	0.～1000.(ms)	0.	X	○	4-82

Note) < > indicate the setting range of 75 to 132kW

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Analog meter setting	C081	O adjustment	0.～9999/1000～6535(10000～65530)	Setting on forwarding	○	○	–
	C082	OI adjustment	0.～9999/1000～6535(10000～65530)	Setting on forwarding	○	○	–
	C083	O2 adjustment	0.～9999/1000～6535(10000～65530)	Setting on forwarding	○	○	–
	C085	Thermistor adjustment	0.0～1000	105.0	○	○	4-64
	C086	AM Offset adjustment	0.0～10.0(v)	0.0	○	○	4-64
	C087	AMI adjustment	0.～255.	80	○	○	4-64
	C088	AMI Offset adjustment	0.～20.0(mA)	Setting on forwarding	○	○	4-64
	C091	Debug mode selection	00(No display)/01(Display)	00	X	○	–
	C101	UP/DOWN selection	00(No frequency data)/01(Keep frequency data)	00	X	○	4-54
	C102	Reset selection	00(Trip cancel during ON)/01(Trip cancel during OFF)/ 02(Valid only during trip <Cancel during ON>)	00	○	○	4-53
	C103	Reset f frequency metching selection	00(0Hz START)/01(Start f- equaling)	00	X	○	4-53
	C111	Overload advance notice level	0.0～2.0*rated current(A)	Inverter rate current	X	○	4-42
	C121	O zero adjustment	0.～9999./1000～6553(10000～65530)	Set on forwarding	○	○	–
	C122	OI zero adjustment	0.～9999./1000～6553(10000～65530)	Set on forwarding	○	○	–
	C123	O2 zero adjustment	0.～9999./1000～6553(10000～65530)	Set on forwarding	○	○	–
Motor constant	H001	Autotuning selection	00(NOR:Invalid)/01(valid(:the motor does not rotate)) /02(valid(the motor rotates)	00	X	X	4-72
	H002	1st motor constant selection	00(Hyundai general purpose motor data)/01(autotuning data)/02(Autotuning data with online autotuning)	00	X	X	4-75
	H202	2nd motor constant selection	00(Hyundai general purpose motor data)/01(autotuning data)/02(Autotuning data with online autotuning)	00	X	X	4-75
	H003	1st allowable motor selection	0.20～75.0(kW)<0.2～160kW>	Set on forwarding	X	X	4-75
	H203	2nd allowable motor selection	0.20～75.0(kW)<0.2～160kW>	Set on forwarding	X	X	4-75
	H004	1st motor pole selection	2/4/6/8(pole)	4	X	X	4-75
	H204	2nd motor pole selection	2/4/6/8(pole)	4	X	X	4-75
	H005	1st speed response setting	0.001～9.999/10.00～65.53	1.590	○	○	4-76
	H205	2nd speed response setting	0.001～9.999/10.00～65.53	1.590	○	○	4-76
	H006	1st stabilized factor	0.～255.	100.	○	○	4-67
	H206	2nd stabilized factor	0.～255.	100.	○	○	4-67
	H306	3rd stabilized factor	0.～255.	100.	○	○	4-67

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Motor constant	H020	1st motor constant R1	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H220	2nd motor constant R1	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H021	1st motor constant R2	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H221	2nd motor constant R2	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H022	1st motor constant L	0.00～99.99/100.0～655.3(mH)	Set on forwarding	X	X	4-75
	H222	2nd motor constant L	0.00～99.99/100.0～655.3(mH)	Set on forwarding	X	X	4-75
	H023	1st motor constant Io	0.00～99.99/100.0～655.3(A)	Set on forwarding	X	X	4-75
	H223	2nd motor constant Io	0.00～99.99/100.0～655.3(A)	Set on forwarding	X	X	4-75
	H024	1st motor constant J	0.001～9.999/10.00～99.99/100.0～9999.(kgm^2)	Set on forwarding	X	X	4-75
	H224	2nd motor constant J	0.001～9.999/10.00～99.99/100.0～9999.(kgm^2)	Set on forwarding	X	X	4-75
	H030	1st motor constant R1 (Autotuning data)	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H230	2nd motor constant R1 (Autotuning data)	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H031	1st motor constant R2 (Autotuning data)	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H231	2nd motor constant R2 (Autotuning data)	0.000～9.999/10.00～65.53(Ω)	Set on forwarding	X	X	4-75
	H032	1st motor constant L (Autotuning data)	0.00～99.99/100.0～655.3(mH)	Set on forwarding	X	X	4-75
	H232	2nd motor constant L (Autotuning data)	0.00～99.99/100.0～655.3(mH)	Set on forwarding	X	X	4-75
	H033	1st motor constant Io (Autotuning data)	0.00～99.99/100.0～655.3(A)	Set on forwarding	X	X	4-75
	H233	2nd motor constant Io (Autotuning data)	0.00～99.99/100.0～655.3(A)	Set on forwarding	X	X	4-75
	H034	1st motor constant J (Autotuning data)	0.001～9.999/10.00～99.99/100.0～9999.(kgm^2)	Set on forwarding	X	X	4-75
	H234	2nd motor constant J (Autotuning data)	0.001～9.999/10.00～99.99/100.0～9999.(kgm^2)	Set on forwarding	X	○	4-75
	H050	1st PI-control proportion gain setting	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H250	2nd PI-control proportion gain setting	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H051	1st PI-control integration gain setting	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H251	2nd PI-control integration gain setting	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H052	1st P-control proportion gain setting	0.01～10.00	1.00	○	○	4-56
	H252	2nd P-control proportion gain setting	0.01～10.00	1.00	○	○	4-56

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Motor constant	H060	1st 0Hz-SLV limiter setting	0～100(%)	100.	○	○	4-77
	H260	2nd 0Hz-SLV limiter setting	0～100(%)	100.	○	○	4-77
	H070	PI-control proportion gain for switching	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H071	PI-control integration gain for switching	0.00～99.99/100.0～999.9/1000.(%)	100.0	○	○	4-56
	H072	P-control proportion gain for switching	0.00-10.00	1.00	○	○	4-56
Option	P001	Option 1 operation selection on error	00(TRP)/01(RUN)	00	X	○	4-67
	P002	Option 2 operation selection on error	00(TRP)/01(RUN)	00	X	○	4-67
	P010	Feed-back option selection	00(Invalid)/01(valid)	00	X	X	Note1)
	P011	Encoder pulse number setting	128.～9999./1000～6500(10000～65000) (pulse)	1024	X	X	Note1)
	P012	Control mode selection	00(ASRmode)/01(APRmode)	00	X	X	Note1)
	P013	Pulse train input mode selection	00(Mode 1)/02(Mode 2)/03(Mode 3)	00	X	X	Note1)
	P014	Orientation stop position setting	0.～4095.	0.	X	○	Note1)
	P015	Orientation speed setting	0.00～99.99/100.0～120.0(Hz)	5.00	X	○	Note1)
	P016	Orientation direction setting	00(Forward)/01(Reverse)	00	X	X	Note1)
	P017	Orientation completion range setting	0.～9999/1000 (pulse)	5	X	○	Note1)
	P018	Orientation completion delay time setting	0.00～9.99(S)	0.00	X	○	Note1)
	P019	Electronic gear position selection	00(Feed-back)/01(Reference)	00	X	○	Note1)
	P020	Electronic gear numerator of ratio setting	0.～9999.	1.	X	○	Note1)
	P021	Electronic gear denominator of ratio setting	0.～9999.	1.	X	○	Note1)
	P022	Position control feed-forward gain setting	0.00～99.99/100.0～655.3	0.00	X	○	Note1)
	P023	Position control loop gain setting	0.00～99.99/100.0	0.50	X	○	Note1)
	P025	Compensation of secondary resistor selection	00(Invalid)/01(valid)	00	X	○	Note1)
	P026	Over-speed detect level setting	0.00～99.99/100.0～150.0(%)	135.0	X	○	Note1)
	P027	Speed-error over detect level setting	0.00～99.99/100.0～120.0(Hz)	7.50	X	○	Note1)
	P031	Digital input option input mode selection (Acc/Dec)	00(operator)/01(option 1)/02(option 2)	00	X	X	Note

Chapter 4 Explanation of function

Function Mode

Code		Function name	Setting range	Initial data	Setting on run	Change mode on run	Page
Option	P032	Stop position setting for orientation input mode selection	00(operator)/01(option 1)/02(option 2)	00	X	○	Note1) Note
	P044	DeviceNet running order of monitoring timer setting	0.00～99.99S	1.00	X	X	Note3)
	P045	Setting in action of abnormal communication	00(Trip)/01(Controlled STOP Trip)/02(Ignore)/ 03(Coast to stop)/04(Controlled stop)	01	X	X	Note3)
	P046	Out assemble instance number setting	20, 21, 100	21	X	X	Note3)
	P047	Input assemble instance number setting	70, 71, 101	71	X	X	Note3)
User selection	P048	Detect of idol mode for motion setting	00(Trip)/01(Controlled STOP Trip)/02(Ignore)/ 03(Coast to stop)/04(Controlled stop)	01	○	X	Note3)
	P049	Pole setting of rotation speed	0～38 (Setting only an even number)	0	X	X	Note3)
	U001	User 1 selection	no/d001-P049<-P032>	no	X	○	4-66
	U002	User 2 selection	no/d001-P049<-P032>	no	X	○	4-66
	U003	User 3 selection	no/d001-P049<-P032>	no	X	○	4-66
	U004	User 4 selection	no/d001-P049<-P032>	no	X	○	4-66
	U005	User 5 selection	no/d001-P049<-P032>	no	X	○	4-66
	U006	User 6 selection	no/d001-P049<-P032>	no	X	○	4-66
	U007	User 7 selection	no/d001-P049<-P032>	no	X	○	4-66
	U008	User 8 selection	no/d001-P049<-P032>	no	X	○	4-66
	U009	User 9 selection	no/d001-P049<-P032>	no	X	○	4-66
	U010	User 10 selection	no/d001-P049<-P032>	no	X	○	4-66
	U011	User 11 selection	no/d001-P049<-P032>	no	X	○	4-66
	U012	User 12 selection	no/d001-P049<-P032>	no	X	○	4-66

Note 1) Refer to the instruction manual of N-FB

Note 2) Refer to the instruction manual of N-DG

Note 3) Indicate the setting range of 5.5～55kW

Chapter 4 Explanation of function

4.3 Explanation of function

4.3.1 Monitor mode

Output frequency monitor

Indication code d001 displays the frequency the inverter outputs.
The data is displayed as follows.
When d001 is displayed, the monitor lamp "Hz" is illuminated.

Relation code
d001 : Output frequency monitor

(Display)
0.00 - 99.99 : Display is in 0.01Hz unit.
100.0 - 400.00 : Display is in 0.1Hz unit.

Output current monitor

Indication code d002 displays the output current value.
The data is displayed as follows.
In case of displaying d002, the monitor lamp "A" is illuminated.

Relation code
d002 : Output current monitor

(Display)
0.0 - 999.9 : Display is in 0.1 A unit

Operation direction monitor

Indication code d003 displays the direction that the Inverter output is rotating. Forward, reverse or stop.
On operating the inverter (in case of forward or reverse), the RUN lamp will illuminate.

Relation code
d003 : Operation direction monitor

(Display)
F : Forward
O : Stop
r : Reverse

PID feedback monitor

When you select PID function (01) in A071, the inverter displays the feedback value changed by A075 (PID scale)
"Display of monitor part" = " Feedback quantity" x "PID scale"
(Frequency command value) (A075)

(Setting)
A071 : 0.1 (PID is effective)
A075 : 0.01 - 99.99 (Display is 0.01 - 99.99 (Set with the 0.01 unit)

Relation code
d004 : PID feedback monitor
A071 : PID selection
A075 : PID scale

(Display)
0.00 - 99.99 : Display is in 0.01 unit.
100.0 - 999.9 : Display is in 0.1 unit.
1000 - 9999 : Display is in 1 unit.
100 - 999 : Display is in 100 unit.

Chapter 4 Explanation of function

Intelligent input monitor

The LED display will monitor the state of the intelligent inputs.

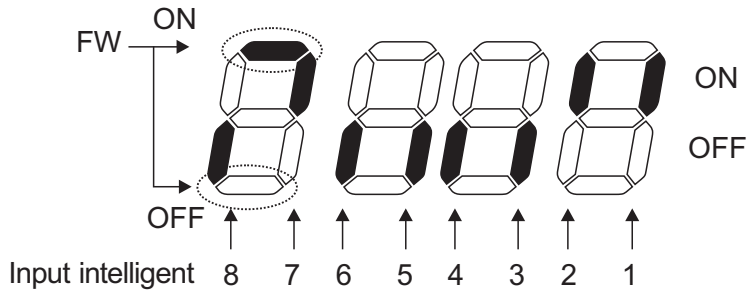
Relation code

d005 : Intelligent input monitor

(Example)

FW : Input intelligent terminal 7, 2, 1 : ON

Input intelligent terminal 8, 6, 5, 4, 3 : OFF



Display

(Black) : Lights up

(White) : Lights out

Intelligent output monitor

The LED display will monitor the state of the intelligent outputs.

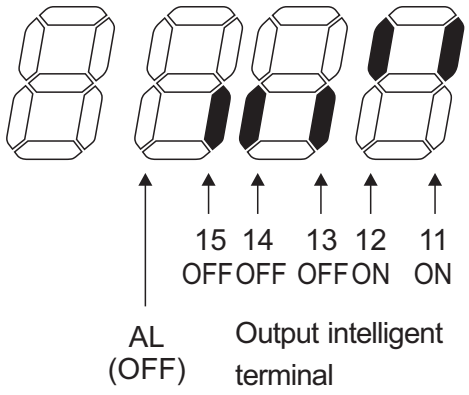
Relation code

d006 : Intelligent output monitor

(Example)

Output intelligent terminal 12, 11 : ON

Output alarm AL, Output intelligent terminal 15, 14, 13 : OFF



Display

(Black) : Lights up

(White) : Lights out

Chapter 4 Explanation of function

Frequency conversion monitor

This inverter displays the value changed by the Inverter output ferquency and the valye set in b086 on the monitor part.

"Monitor part of display" = "output frequency9d001)" x "output frequency factor(b086)"

(Display) Display of d007

0.00 - 99.99 : Display is in 0.01 unit.
100.0 - 999.9 : Display is in 0.1 unit
100. - 9999. : Display is in 1 unit.
1000 - 3996 : Display is in 10 unit.

Relation code

d007 : Frequency conversion monitor
b086 : Frequency conversion factor

(Range of setting) The setting range of b086

0.1 - 99.9 : Set it with the 0.1 unit.

(Example) Output frequency (d001) :50.00Hz

When the frequency conversion factor (b086) is 1.1,
the frequency conversion monitor (d007) displays "55.00" as "50 x 1.1 = 55.00"

(Note) Output frequency of FW terminal becomes same as b007 at the time of setting up the digital output frequency to the FW terminal.

Output torque monitor

This inverter displays the output torque estimation value.
The monitor lamp "%" should illuminate while the contents of d012 are displayed.
Display substitutes only at the time of the sensorless vector control, 0Hz domain sensorless vector control and vector control.

Relation code

d012 : Output torque monitor

(Display)

-300.0 - 300.0 : Display is in 1% unit

Output voltage monitor

This inverter displays the output voltage of the inverter converted into the alternating voltage.
The monitor lamp "V" should illuminate while the contents of d013 are displayed.

Relation code

d013 : Output voltage monitor

(Display)

0.0 - 600.0 : Display is in 0.1V unit.

Input electric power monitor

Display input electric power from inverter.
The monitor lamp "kW" ("V" and "A") should illuminate while the contents of d014 is displayed.

Relation code

d014 : Input electric power monitor

(Display)

0.0 - 999.9 : Display is in 0.1kW unit.

Chapter 4 Explanation of function

Accumulated time monitor on RUN

The operation time of inverter is accumulated and the value is displayed.

(Display)

0. - 9999. : Display is in 1 hour units.
1000 - 9999 : Display is in 10 hour unit
100. - 999 . : Display is in 1000 hour unit.

Relation code

d016 : Accumulated time monitor on RUN

Power ON time monitor

This accumulates the time running to the inverter and displays the value.

(Display)

0. - 9999. : Display is in 1 hour units.
1000 - 9999 : Display is in 10 hour unit
100. - 999 . : Display is in 1000 hour unit.

Relation code

d017 : Power ON time monitor

Trip time monitor

This displays the number of inverter trips.

(Display)

0. - 9999. : Display is in 1 hour units.
1000 - 6553 : Display is in 10 hour unit

Relation code

d080 : Trip time monitor

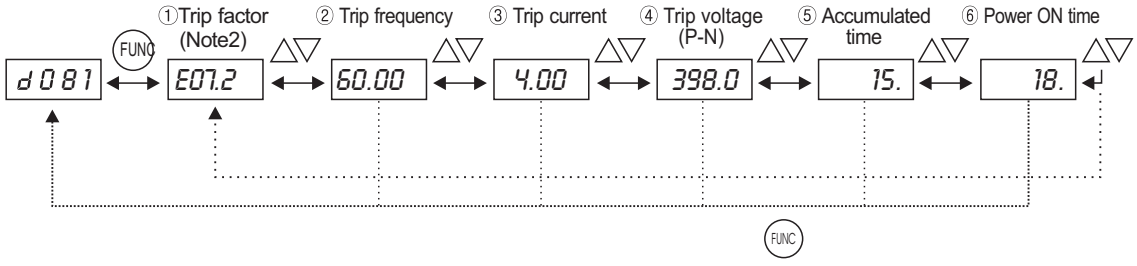
Trip monitor 1 - 6

This displays the details for the last six protective trips.
The trip monitor 1 displayed the details of the last trip.
(Display contents)
[1] Trip code (Display anything from E01 to E79) (Note1)
[2] Output frequency on tripping (Hz)
[3] Output current on tripping (A)
[4] The direct voltage (between P and N) on tripping (V)
[5] The accumulated time inverter was operating until tripping (h)
[6] The accumulated time inverter was run until tripping (h)
(Note 1) Please refer to the pages 4.4 protection function list (2) Trip monitor display.

Relation code

d081 : Trip monitor 1
d082 : Trip monitor 2
d083 : Trip monitor 3
d084 : Trip monitor 4
d085 : Trip monitor 5
d086 : Trip monitor 6

The methods of trip monitor



(Note 2) In case of no tripping [_ _ _ _] is displayed.

Chapter 4 Explanation of function

4.3.2 Function mode

Relation code
F001 : Output frequency setting
A001 : Frequency command select
A020/A220/A320 : 1ST/2nd/3rd multistage speed zero
C001 - C008 : Intelligent input terminal

Output frequency setting

Setting the output frequency of the motor.
The output frequency is set by F001, when frequency command select (A001) is set to 02.
Please frequency command select (A001) about other methods of frequency setting.
When a frequency is set in F001, the same value is automatically set in 1st multi-stage zero speed (A020) . Set up with F001 in the condition where turned on the set terminal, whether or not it sets up with the 2nd multi-stage zero speed (A220) / the 3rd multi-stage zero speed (A320), in the case that the 2nd/3rd control is set up.
In the case of using SET/SET3, you will need to assign 08 (SET) / 17(SET3) to an intelligent input terminal.

Set item	Function code	Data	Contents
Output frequency setting	F001	0.0, start frequency 1st/2nd/3rd maximum frequency	Unit : Hz "F001" = "A020" Second control setting of "F001" = "A220" Third control setting of "F001" = "A320"
Multistage speed zero	A020/A220/A320		

Operation direction

This is effective when the operating command is set by the digital operator.

Function code	Data	Contents
F004	00	Forward
	01	Reverse

Relation code
F004 : Operation direction select

Selection with limits of operation direction

The direction of the motor can be restricted.

Function code	Data	Contents
b035	00	Forward/reverse is effective.
	01	Only forward
	02	Only reverse

Relation code
d035 : Selection with limits of operation direction

Frequency command selection

Select the method of frequency command.
When 0-10Vdc is inputted to the frequency command by 02-L terminal, operation direction of motor reverses.
On output frequency monitor d001, you can't get information about forward/reverse. So be sure with operation direction monitor d002.

Relation code
A001 : Frequency command Selection

Function code	Data	Contents
A001	00	(Setting frequency with the potentiometer the digital operator has.) (Note1)
	01	Setting frequency with control terminals (Terminals: O-L, O1-L, O2-L)
	02	Setting frequency with digital operator (F001), remote operator
	03	Setting frequency with RS485 terminals for communication
	04	Setting frequency with option board 1.
	05	Setting frequency with option board 2.

(Note 1) : Setting is possible at the time of the OPE-SR installation

Chapter 4 Explanation of function

Operation command selection

Select the control of RUN/STOP commands.
Operation command from the control terminals (Teminal)
Start/Stop by ON/OFF of control terminals.
Forward : FW-CM1 terminal
Reverse : RV-CM1 terminal
Put 01(RV) to an intelligent input terminal
When using the FW terminal, it is possible th change the contact from NO to NC by settin a or b (respectively) in C019.
When operating from the digital operator, set operation in F004.
Or operate start/stop with RUN key/STOP key on the digital operator.
When forward command and reverse command entered simultaneously, operation command be comes stop command

Relation code

A002 : Operation command selection
C001-C008 : Intelligent input terminal
C01 9 : Inputting FW a/b (NO/NC) selection
F004 : Operation direction select

Set item	Function code	Data	Contents
Operation command selection	A002	01	Start/stop with control terminals (Terminals: FW, RV)
		02	Start/stop with digital operator (F001), remote operator
		03	Start/stop with RS485 terminals for communication
		04	Start/stop with option board 1.
		05	Start/stop with option board 2.
Input FW/ a/b (NO/NC) selection	C019 C011-C018	00	a contact (NO)
		01	b contact (NC)

Selection on stop

When stop is commanded from the digital operator or the control terminals (Terminal), select the stop after slowing-down according to slowing-down time or the free run stop. When the second cycle is started while in free run stop, the inverter follows the free-run stop selection b088 and restarts.
(Refer to the item of free-run stop)

Relation code

d091 : Selection on stop
F003/F203/F303 : $1^{ST}/2^{nd}/3^{rd}$ deceleration time
b003 : Waiting time for retrying
b007 : Frequency setting to match
b088 : Select for free-run stop

Set item	Function code	Data	Contents
Selection on stop	b091	00	Normal stop (Decelerated stop)
		01	Free-run stop
Selection of free-run stop	b088	00	0Hz start
		01	Start frequency matching
Frequency setting to match	b007	0.00-400.0	Unit :Hz
Waiting time for retrying	b003	0.3-100	Unit : second

Selection of stop key

Even though the control terminals are selected for the operation command, you can still set whether the stop key of operator (digital operator etc) is effective or not. Trip reset function by the stop key complies with this setting, too.

Function code	Data	Contents
b087	00	The stop key is effective
	01	The stop key is ineffective

Relation code

b087 : Selection of stop key

Chapter 4 Explanation of function

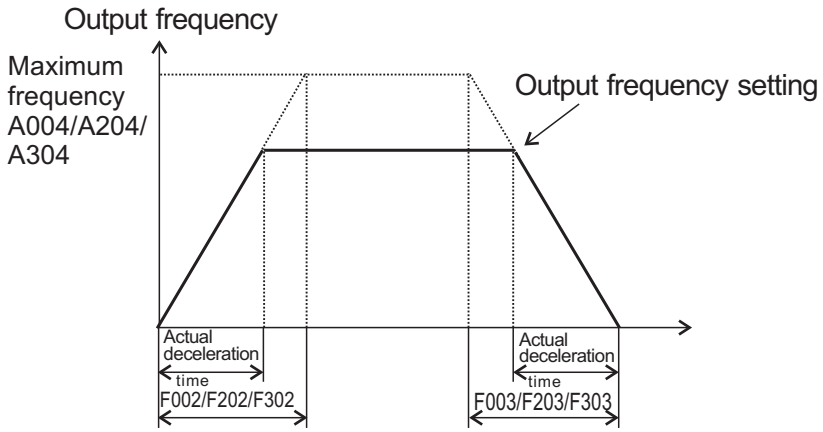
Adjustable time

Relation code

F002/F202/F302 : 1ST/2nd/3rd acceleration time
F003/F203/F303 : 1ST/2nd/3rd deceleration time
A004/A204/A304 : 1ST/2nd/3rd maximum frequency
C001-C008 : Intelligent input selection

The acceleration and deceleration time can be set.
Set a long time to accelerate or decelerate slowly or set a short time to accelerate or decelerate quickly.
The time setting is the time it takes to accelerate from zero to the maximum frequency and to decelerate from the maximum frequency to zero.
Switching of the 1ST/2nd/3rd acceleration time and the 1ST/2nd/3rd deceleration time can be controlled with intelligent input terminal assigned to 08 (SET)/17(SET3).
When select the LAD cancel (LAC) function to intellingent input and turn on the signal acceleration/ deceleration time is disregarded and the output frequency flatters the command frequency instantaneously.

Set item	Function code	Limit of setting	Contents
Acceleration time	F002/F202/F302	0.01 - 3600.	Unit : second Setting acceleration time from zero to maximum frequency.
Deceleration time	F003/F203/F303	0.01 - 3600.	Unit : second Setting acceleration time from zero to maximum frequency.
Intelligent input selection	C001-C008	46	LAD cancel



However short you set the adjustable time, the adjustable time of the actual motor can't be shorter than the shortest adjustable time determined by the inertial Effect J of the mechanical system and motor torque.
If you set the time shorter than the shortest adjustable time, a protection trip of OC or OV may occur.

Acceleration time t_s

$$t_s = \frac{(J_L+J_M)\times N_M}{9.55\times(T_S-T_L)}$$

Deceleration time t_B

$$t_B = \frac{(J_L+J_M)\times N_M}{9.55\times(T_S-T_L)}$$

J_L : J of the load converter into motor shaft ($kg.m^2$)
J_M : J of the motor ($kg.m^2$)
N_M : Motor revolving (r/min)
T_S : The maximum motor acceleration torque on inverter driving (N·m)
T_S : The maximum motor deceleration torque on inverter driving(N·m)
T_L : Needed transit torque (N·m)

Chapter 4 Explanation of function

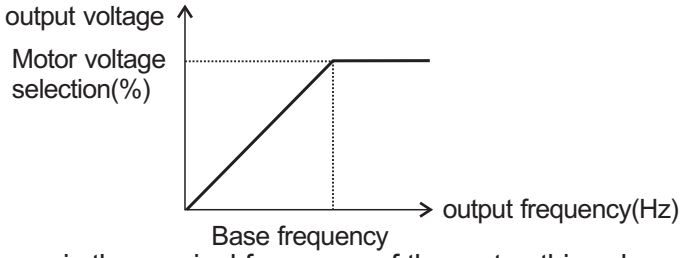
Base frequency

Base frequency and motor voltage
AVR function

Relation code
A003/A203/A303:1ST/2nd/3rd maximum frequency

(1) Base frequency and motor voltage

On selection of base frequency and motor voltage, set the output of the inverter (frequency voltage) to the motor rating



The base frequency is the nominal frequency of the motor, this value can be found on the nameplate of the motor. It is important to match the base frequency (A003) to this nominal value or there is risk of damage to the motor.

If a motor has a base frequency higher than 60Hz, it is considered to be a special motor. In this situation, it is important to make sure the maximum output current of the inverter is higher then the FLC of the motor.

The Motor Voltage selection is the nominal voltage of the motor, this value can be found on the nameplate of the motor. It is important to match the motor voltage (A082) to this nominal value or there is risk of damage to the motor.

When changing second base frequency (A203) / third base frequency (A303) an intelligent input terminal must be set to 08 (SET) / 17(SET3) and switched on.

Set item	Function code	Limit of setting	Contents
Base frequency	A003/A203/A303	30.-1ST/2nd/3rd maximum frequency	Unit :Hz
Motor voltage selection	A082	200/215/220/230/240	Unit:V When inverter is 200 V class, selection is possible.
		380/400/415/440/460/480	Unit:V When inverter is 400 V class, selection is possible.

(2) AVR function

Even if the incoming voltage changes, this function will keep the output voltage and a constant voltage level. The output voltage to the motor in this function references to the voltage selected on motor voltage selection. Select Yes/No of this function on A081 AVR selection.

Function code	Data	Contents	Description
A081	00	Always ON	This function is effective on acceleration, constant speed, deceleration
	01	Always OFF	This function is ineffective on acceleration, constant speed, deceleration
	02	On decelerating OFF	This increases a loss of motor and reduce the energy regene-rated to inverter on decelerating.

Chapter 4 Explanation of function

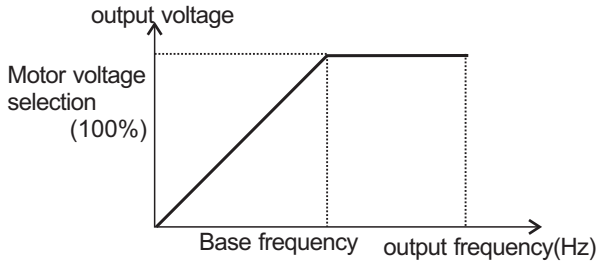
Maximum frequency

Set the maximum frequency value of the inverter.
This set value is the maximum frequency that the inverter will achieve when it receives top speed reference from the control terminals or the digital operator.

Relation code
A004/A204/A304:1ST/2nd/3rd maximum frequency

To the change the 1ST/2nd/3rd maximum frequency, set an intelligent input terminal to 08(SET)/17(SET3) and switch the input ON.
The inverter output voltage from the base frequency to the maximum frequency is the same level as the voltage selected on the motor voltage selection

Function code	Limit of setting	Contents
A004/A204/ A304	30. - 400.	Unit ; Hz



Carrier frequency

The carrier frequency of the PWM wave-from output from the inverter is adjustable changing b083.
If the carrier frequency is set higher, the audible noise from motor will be reduced but the RF1 noise and the leakage current may be increased.
This function may help to avoid the resonant frequency of the motor or the mechanical system

Relation code
b083 : Carrier frequency

Function code	Limit of setting	Contents
b083	0.5-15.0 (Note1)	Unit : kHz 5.5 to 55kW
	0.5-10.0 (Note1)	Unit : kHz 75 to 132kW

(Note 1) The maximum value of the carrier frequency in order to achieve full output current is different depending on the capacity. When raising the carrier frequency, the rated output current will be reduced.

Voltage class	200V class		400V class	
contents	Maximum carrier frequency	Derating on carrier frequency=15kHz	Maximum carrier frequency	Derating on carrier frequency=15kHz (10kHz 75kW to 1320kw
5.5Kw	15	100%	15	100%
7.5Kw	15	100%	15	100%
11Kw	15	100%	15	100%
15Kw	12	95%(below 60.8A)	15	100%
18.5Kw	8	80%(below 60.8A)	15	100%
22Kw	5	65%(below 61.8A)	6	80%(below 38.4A)
30Kw	5	80%(below 96.8A)	10	75%(below 43.5A)
37Kw	10	90%(below 130.5A)	10	95%(below 71.2A)
45Kw	7	70%(below 127.4A)	10	80%(below 72A)
55Kw	6	70%(below 154A)	6	60%(below 66A)
75Kw	—	—	8	95%(below 141.5A)
90Kw	—	—	6	80%(below 140.8A)
110Kw	—	—	6	70%(below 151.9A)
132Kw	—	—	3	60%(below 156A)

Be sure to keep the above-,emtioned table.
Otherwise, there is a danger of inverter unit breakage.

Chapter 4 Explanation of function

External analog input (0, 02, 01)

Relation code

A005 : AT terminal selection
A006 : 02 Selection
C001-C008 : Intelligent input terminal

This inverter has three kinds of external analog input terminals.

- O-L terminal : 0 - 10V
- O1-L terminal : 4 - 20mA
- O2-L terminal : -10 / 0 / +10V

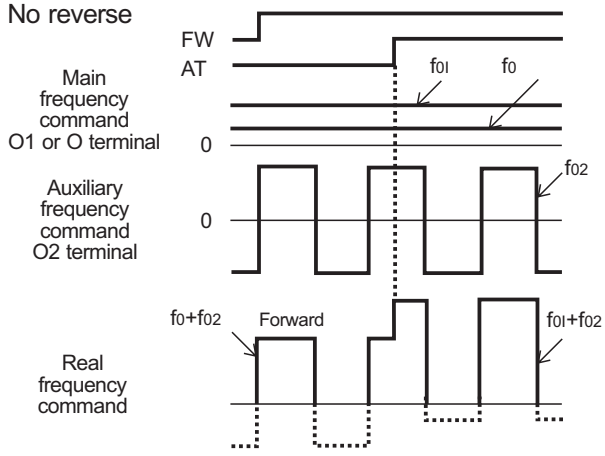
The setting contents of this function is as follows.

Setting item	Function code	Data	Contents
AT terminal selection	A005	00	Change of O/O1 with AT terminal { AT terminal ON : O1-L valid / AT terminal OFF : O-L valid }
		01	Change of O/O2 with AT terminal { AT terminal ON : O2-L valid / AT terminal OFF : O-L valid }
02 selection	A006	00	Single
		01	Auxiliary frequency command of O, O1 (No reverse)
		02	Auxiliary frequency command of O, O1 (Reverse)

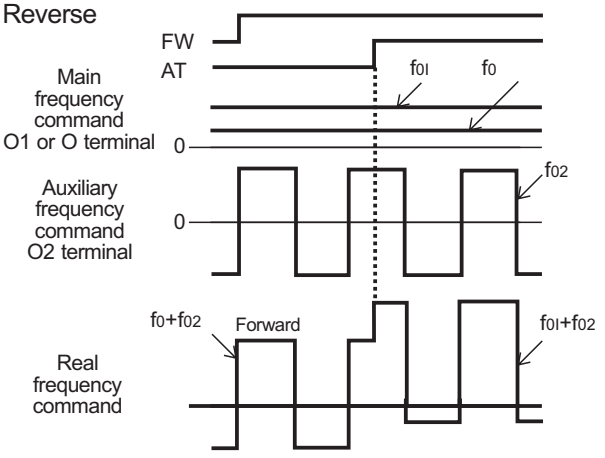
Assign 16(AT) to intelligent input terminal.
The frequency setting is the values from terminals O, O1 and O2 when 16(AT) isn't assigned. The frequency set up when A006 is "00" becomes the value of O2. And, the frequency set up when A006 is "01" or "02" becomes the value which O1 and O2 were added to.
The following frequency command methods are available by combining A005, A006 with the intelligent input AT terminal.
In the case that reverse and FW (forward) terminals are ON, the inverter operates reversely when (main frequency command + auxiliary frequency command) < 0.

	A006	A005	AT terminal	Main frequency command	Existence of Auxiliary frequency command(02-L)	Existence of Reverse
Intelligent input terminal on assigning AT	00	00	OFF	O-L	No	No
			ON	OI-L	No	
		01	OFF	O-L	No	
			ON	O2-L	No	Yes
	01	00 (Ex1)	OFF	O-L	Yes	No
			ON	OI-L	Yes	
		01	OFF	0-L	Yes	
			ON	O2-L	No	No
	02	00 (Ex2)	OFF	O-L	Yes	Yes
			ON	OI-L	Yes	
		01	OFF	O-L	Yes	
			ON	O2-L	No	
Intelligent input terminal when Don't assign AT	00	—	—	O2-L	No	Yes
	01	—	—	Adding O-L and OI-L	Yes	No
	02	—	—	Adding O-L and OI-L	Yes	Yes

(Example 1)
No reverse



(Example 2)
Reverse



Chapter 4 Explanation of function

External frequency Start / End

External analog signal from the control terminals (frequency command)

O-L terminal : 0 - 10V
O1-L terminal : 4 - 20mA
O2-L terminal : -10 / 0 / +10V

Set output frequency for one of the above

(1) Start, End of O-L terminal, O1-L terminal

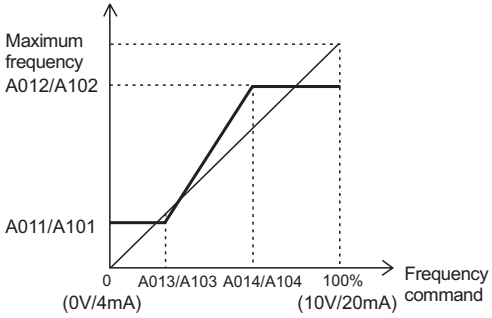
Relation code

A011 : O start	A103 : OI start rate
A012 : O end	A104 : OI end rate
A013 : O start rate	A105 : OI start selection
A014 : O end rate	A111 : O2 start
A015 : O start selection	A112 : O2 end
A101 : OI start	A113 : O2 start rate
A102 : OI end	A114 : O2 end rate

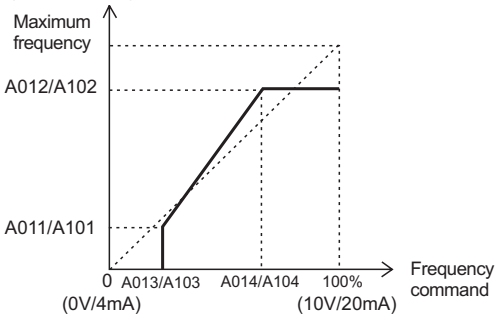
Set item	Function code	Data	Contents
O/OI start	A011/A101	0.00-400.0	Unit : Hz set starting frequency
O/OI end	A012/A102	0.00-400.0	Unit : Hz Set ending frequency
O/OI start rate	A013/A103	0.100.	Unit : % Set start rate for output frequency command 0-10V, 4-20mA
O/OI end rate	A014/A104	0.100.	Unit : % Set start rate for output frequency command 0-10V, 4-20mA
O/OI start selection	A015/A105	00	External start frequency Output frequency from 0 to A013/A103 outputs the value of A011/A101
		01	0Hz Output frequency from 0 to A013/A103 outputs the value of 0Hz

When the input is from 0 to 5V with O-L terminal, set A014 to 50%

(Example 1) A015/A105 : 00



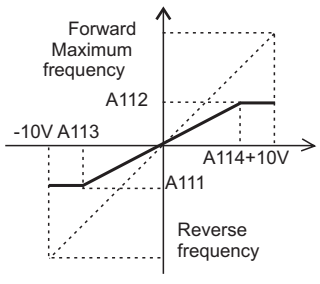
(Example 2) A015/A105 : 00



(2) Start, End of O2-L terminal

Set item	Function code	Data	Contents	Notes
O2 start	A111	-400.～400	Unit : Hz Set starting frequency	(Example 3)
O2 end	A112	-400.～400	Unit : Hz Set starting frequency	
O2 start rate	A113	-100.～100	Unit : % Set starting rate for output frequency command -10-10V (Note 1)	
O2 end rate	A114	-100.～100	Unit : % Set starting rate for output frequency command -10-10V (Note 1)	

(Note 1) The rates of -10V-10V is following
-10V-0V : -100-0%
0V-10V : 0-100%
For example, in case of use with O2-L terminal, set -50% to A113 50% to A114



Chapter 4 Explanation of function

Setting analog input filter

Relation code

A016 : O, O1, O2 filter

Set the internal filter of the frequency setting signal of voltage or current from the control terminals

It is important to first remove the source of the noise to the system.

When stable operation can not be achieved due to the effect of electrical noise, set a larger value.

The response will be slower by setting a larger value. The limit of setting is about 10ms-60ms (set value : 1-30)

Function code	Limit to set	Contents
A016	1. - 30.	Can set with the 1 unit.

Output voltage gain

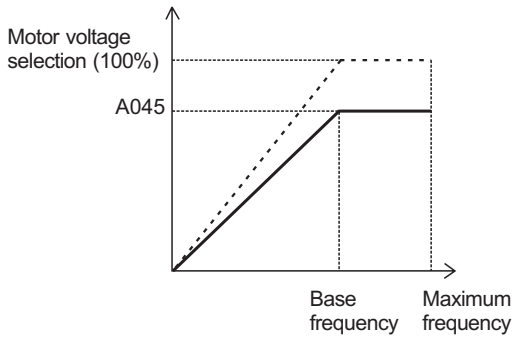
Regarding the voltage selected on A082 motor voltage selection as 100% set the rate of the voltage which the inverter outputs for the voltage selected.

Function code	Limit to set	Contents
A045	20. - 100.	Unit : %

Relation code

A045 : Output voltage gain

A082 : Motor voltage selection



Chapter 4 Explanation of function

Control system (V/f Characteristic)

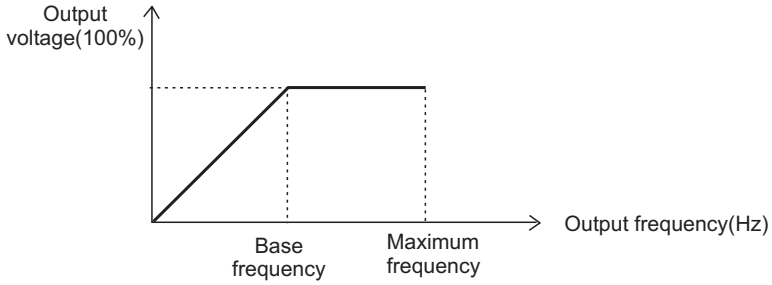
Set V/f (output voltage/ output frequency) characteristic
To change 1st / 2nd /3rd control system (V/f characteristic), set 08(SET) / 17 (SET3) to an intelligent input terminal and switch it ON.

Relation code

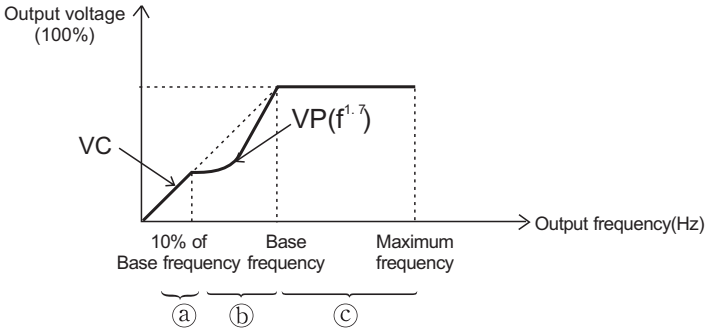
A044/ A244/A344:1st / 2nd /3rd control system
b001/b102/b104/b106/b108/b110/b112
: Free setting V/f frequency 1/2/3/4/5/6/7
b101/b103/b105/b107/b109/b111/b113
: Free setting V/f voltage 1/2/3/4/5/6/7

Function code	Data	V/f characteristic	Remarks
A044/A244/ A344	00	Constant torque characteristic (VC)	—
	01	Reduced torque characteristic(VP1.7 power)	—
	02	Free setting V/f characteristic	Only A044/A244
	03	Sensorless vector control	Only A044/A244
	04	0Hz domain sensorless vector control	Only A044/A244
	05	Sensorring vector control (V2)	Only A044

(1) Constant torque characteristic(VC)
Output voltage output proportionally to the output frequency.
Output voltage outputs proportionally from 0 to the base frequency, but the output voltage from the base frequency to the maximum frequency is constant regardless of frequency.



(2) Reduced torque characteristic (VP1.7 power)
This characteristic can be used when a large starting torque isn't required.
At low speeds, it can cause improvement of efficiency, low noise and low noise and low vibration because of lowering the output voltage. V/f characteristic is as follows.



Period ⓐ : The limit from 0 to 10% of basic frequency is the constant characteristic.
(Example) If the base frequency is 60Hz, the limit from 0 to 6Hz is constant characteristic.
Period ⓑ : The limit from 10% of base frequency to base frequency is reduced torque characteristic.
The voltage is output in the curve of 1.7 power for frequency.
Period ⓒ : The voltage is constant from the base frequency to the maximum frequency.

Chapter 4 Explanation of function

(3) Free V/f setting

The free V/f setting optional V/f characteristics by setting the voltage and frequency in seven parts.(b001-b113)

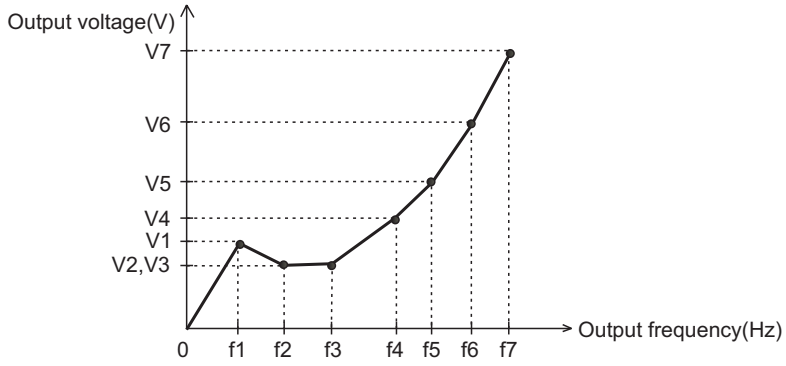
The setting of free V/f setting operates always to be 1≤2≤3≤4≤5≤6≤7.

Please set first free V/f setting 7 because the initial value is all 0Hz.

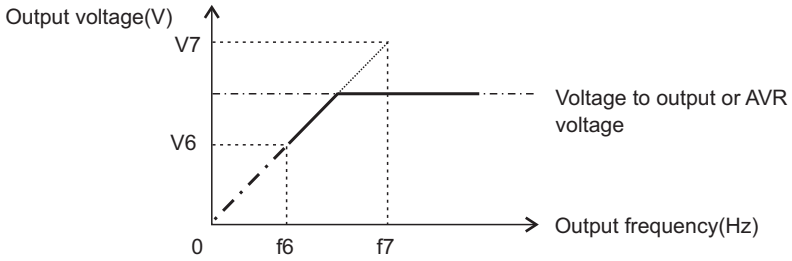
When the free V/f setting valid, the function of torque boost (A041/A241), basic frequency (A003/A203/A303), maximum frequency(A004/A204/A304) is invalid. (Free V/f frequency 7 is treated as maximum frequency).

Set item	Function code	Date	Contents
Free V/f frequency 7	b112	0.-400.	Unit : Hz
Free V/f frequency 6	b110	0.-Free V/f frequency 7	
Free V/f frequency 5	b108	0.-Free V/f frequency 6	
Free V/f frequency 4	b106	0.-Free V/f frequency 5	
Free V/f frequency 3	b104	0.-Free V/f frequency 4	
Free V/f frequency 2	b102	0.-Free V/f frequency 3	
Free V/f frequency 1	b100	0.-Free V/f frequency 2	
Free V/f voltage 7	b113	0.0-800.0	Unit : V (Note 1)
Free V/f voltage 6	b111		
Free V/f voltage 5	b109		
Free V/f voltage 4	b107		
Free V/f voltage 3	b105		
Free V/f voltage 2	b103		
Free V/f voltage 1	b101		

(Example)



(Note1) Even if you set 800V for free V/f voltage 1-7, output of inverter can't be more than input voltage or the AVR setting voltage.



Chapter 4 Explanation of function

Torque boost

A correctly installed motor and careful attention to voltage drop in the wiring will improve the motor torque at low speed. Setting of A041/A241 will select between manual torque boost and automatic torque boost, the level of torque boost corresponds to the set motor capacity selection (H003/H203) and the motor pole selection (H004/H204).

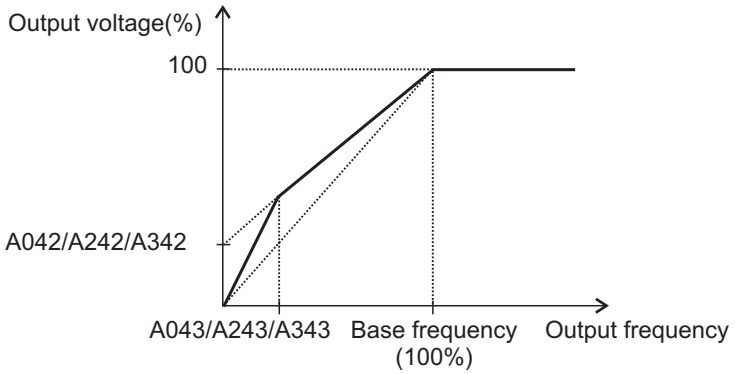
Relation code

A041/ A241 :1st / 2nd /3rd torqrue boost selection
A042/A242/A342:1st / 2nd /3rd manual operation torque boost
A043/A243/A343:1st / 2nd /3rd manual operation torque boost break point
H003/H203 : 1st / 2nd motor capacity selection
H004/H204 : 1st / 2nd motor pole selection

Set item	Function code	Date	Contents
Torque boost	A041/A241	00	Manual torque boost
		01	Automatic torque boost
Manual torque boost	A042/A242/ A342	0.0-20.0	Unit : % Level corresponding output Voltage(100%)
Manual torque boost break point	A043/A243/ A343	0.5-50.0	Unit : % Level corresponding to base frequency

(1) Manual torque boost

The values set up with A042/A242/A342 and A043/A243/A343 is outputted.
A042/A242/A342 sets a percentage level where the base frequency voltage is 100%.
The level set is the value of torque boost output voltage at 0Hz.
When using the manual torque boost, it should be noted that overuse will cause saturation of the motor and may cause damage.
The manual torque boost break point is the frequency at which the voltage torgue boost is switched off and normal operation resumes.
To change of A041,A042,A043/A241,A242,A243/A342,A343 an intelligent input needs to be set to 08(SET)/ 17(SET3) and switched on.



(2) Automatic torque boost

The output voltage is adjusted automatically by condition of the load.
When using automatic torque boost it important that the following two parameters art correctly.
In case of adding over-current protection at deceleration time, set AVR selection ON all the time.

Set item	Function code	Setting limit	Contents
Motor capacity selection	H003/H203	0.20-75.0(0.4 to 55kW)	Unit : kW
		0.20-160.0(75 to 150kW)	
Motor pole selection	H004/H204	2/4/6/8	Unit : pole

Chapter 4 Explanation of function

Direct current braking(DB)

A dc voltage can be applied to the motor windings in orde to lock the motor shaft and avoid overun at low speeds.
There are two methods of activating the dc braking, Outside which is through the intelligent input terminals and inside which is automatically started at a specific frequency.

Relation code

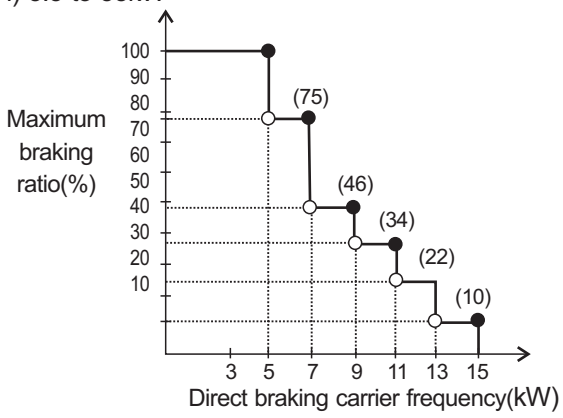
A051:DC braking selectiond
A052:DC braking frequency
A053:DC braking late time
A054:DC braking power
A055:DC braking time
A056:DC braking edge/level selection
A057:Starting DC braking power
A053: Starting DC braking time
A054:DC carrier frequency
C001-C008: Intelligent input terminal

Set item	Functin code	Data	Contents
DC braking selection	A051	00	Inside DC braking : invalid
		01	Inside DC braking : valid
DC braking frequency	A052	0.00-60.00	Unit : Hz When the output reaches the set frequency and Inside DC braking is valid, DC braking is started.
DC braking late time	A053	0.0-5.0	Unit : second After DC braking time is reached, or DB terminal is ON, the late time is a delay before DC braking is started.
DC braking power starting DC braking power	A054/A057	0. ↕ 100.(80.)	Unit : % Weak (Zero current) ↕ Strong (0.4 to 55kW : Range is from 0 to 100%) (75 to 132kW : Range is from 0 to 80%)
DC braking time	A055	0.0-60.0	Unit : second The DC braking is stopped after this time delay has elapsed. The time is tarted when the late time has elapsed.
DC braking edge/level selection	A056	00	Edge movement (Example 1-6-a)
		01	Level movement (Example 1-6-b)
Staring DC braking time	A058	0.0-60.0	Unit : second It is valid for inside DC braking. When operating command is ON, DC current is started.
DC braking carrier Frequency	A059	0.5-15	Unit : kHz(0.4 to 55kW)
		0.5-10	Unit : kHz(75 to 132kW)

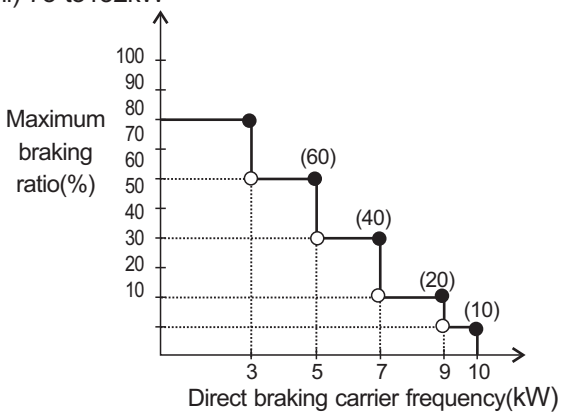
(1) DC braking carrier frequency

It is possible to alter the DC braking carrier frequency. Set DC braking carrier frequency with A059.
However, Maximum braking power level is automatically reduced by DC breaking carrier frequency as follows.
5.5 to 55kW are according to (i). 75kW to 132kW are according to (ii)

i) 5.5 to 55kW



ii) 75 to132kW



Direct braking power limiter

Chapter 4 Explanation of function

(2) Outside DC braking

Set 07(DB) to an intelligent input terminal.

DC braking is then switched by ON/OFF of DB terminal irrespective of DC braking selection A051.

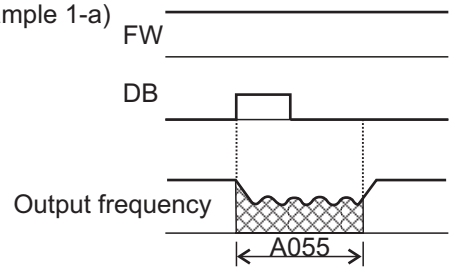
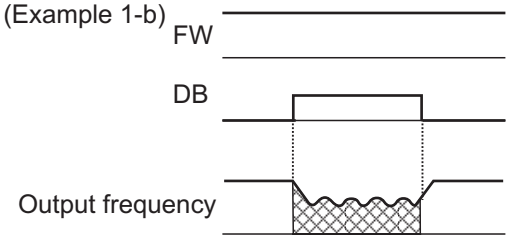
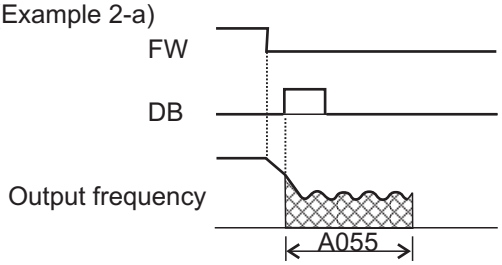
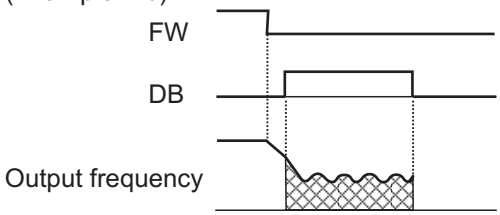
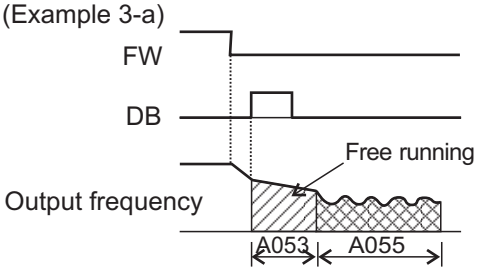
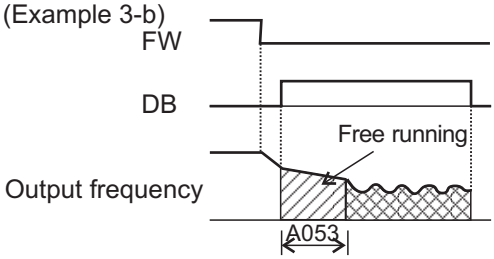
Set strength of DC braking power with A054.

If DC braking late time A053 is set, the Inverter output is cut off for this time period, the motor will be free running.

After the late time passes, DC braking is started.

Please set DC braking time A055 or DC braking time by DB terminal paying attention to the heat of the motor.

Please set each setting in accordance with the system, after level action or edge action are selected with A056.

(a) Edge operation (A056 : 00)	(b) Level operation (A056 : 01)
(Example 1-a) 	(Example 1-b) 
(Example 2-a) 	(Example 2-b) 
(Example 3-a) 	(Example 3-b) 

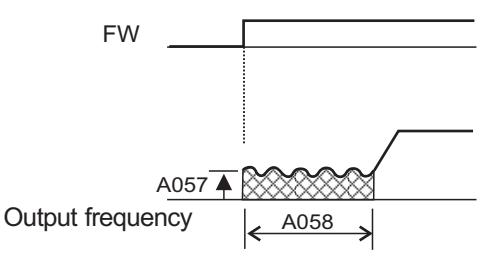
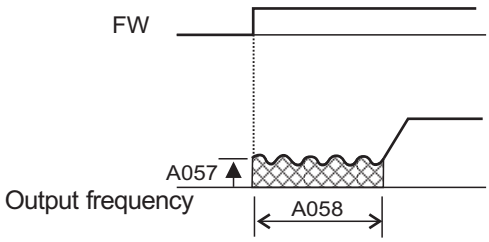
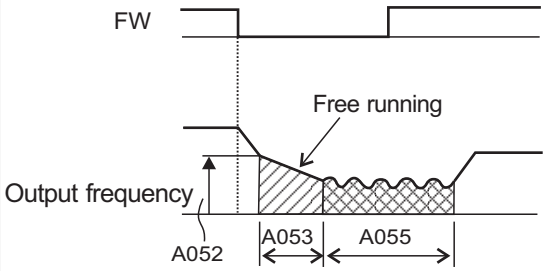
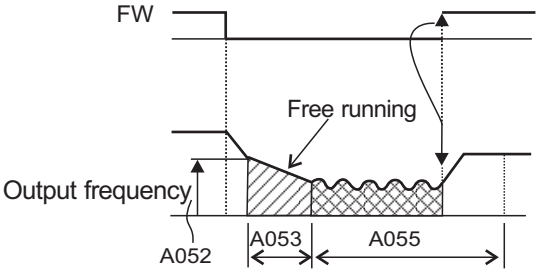
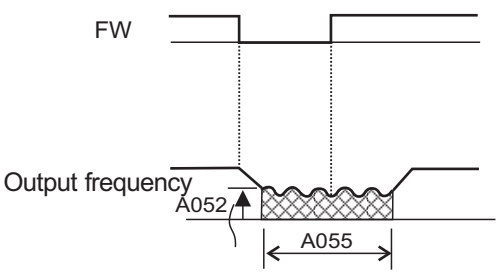
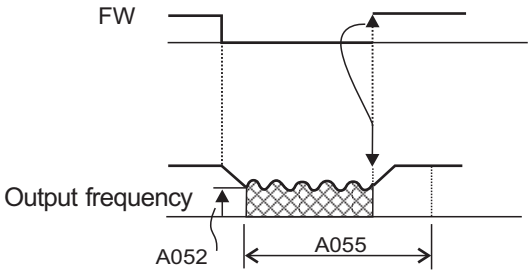
Chapter 4 Explanation of function

(3) Inside DC braking

When the inverter starts, and the DB terminal is not ON the inverter can operate dc braking.
When using inside DC braking, the DC braking selection A 051 should be set 01.
Starting DC braking power is set with A057, DC braking time at starting is set with A058.
Braking power setting except starting time, set with A054.
If DC braking late time A053 is set and the dc braking frequency is reached, the operating command (FW) is switched OFF. The inverter cuts the output and for the set time of A053, free running of the motor will occur. After finishing the set time in A053, DC braking is started.
Set the frequency at which the DC braking will operate at with A052.
The operation of Edge/Level selection when using inside DC braking is different.

Edge action : Give priority to A055 DC braking action action time, operate DC braking according to set time. After turning operating command (FW) OFF, when output frequency reachs the set value of A052, during setting A055 DC braking is run. Even if operation command is turned ON, during setting time of A055, DC braking is run. (Example 5-a), (Example 6-a)

Level action : Give priority to operating command, ignore DC braking time A055 and move to normal operation. When operation command is turned ON during DC braking, set time of A055 is ignored and normal operation is restored. (Example 5-b), (Example 6-b)

(a) Edge action	(b) Levela action
1) When starting (Example 4-a) 	1) When starting (Example 4-b) 
2) When stopping (Example 5-a) 	2) When stopping (Example 5-b) 
3) When stopping (Example 6-a) 	3) When stopping (Example 6-b) 

Chapter 4 Explanation of function

Frequency limiter

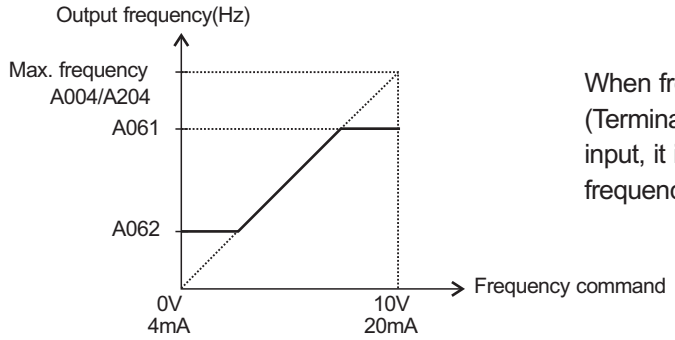
Relation code

A061/A261 : 1st / 2nd frequency maximum limiter
A062/A262 : 1st / 2nd frequency minimum

This function can set a maximum and minimum limit of the output frequency.
Even if a frequency command exceeds the maximum and minimum limiter the inverter will ignore this value and stop at the values set.
Set first maximum limiter on setting.
Be sure that the maximum limiter (A061/A261) > minimum limiter (A062/a262).
The maximum and minimum limiter will not operate if 0Hz is set.
This function is not available under third control function.

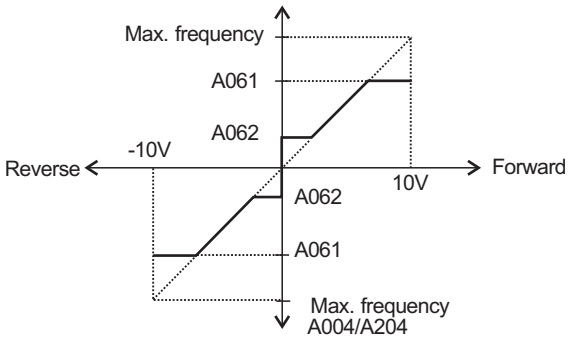
Set item	Function code	Setting limit	Contents
Frequency max. limiter	A061/A261	0.00 frequency min. limiter - max. limiter frequency	Unit : Hz Setting max. of output frequency
Frequency min. limiter	A062/A262	0.00 starting frequency - max. limiter frequency	Unit : Hz Setting min. of output frequency

(1) In use O-L, O1-L case



When frequency command is control terminal (Terminal), by setting Min. limiter, even if 0V is input, it is not possible to output less than the frequency set with Min. limiter.

(2) In use O2-L case



When using the minimum frequency limiter and 0V is inputted into O2 terminal, A062 applies to both forward and reverse directions.
(a) When operation command is control terminal (Terminal) (A002:01)

Terminal	Revolution when O2 is 0V
FW(ON)	A062 on forward side
RV(ON)	A062 on reverse side

(b) When operation command is operator (A002:02)

F004	Revolution when O2 is 0V
00	A062 on forward side
01	A062 on reverse side

Chapter 4 Explanation of function

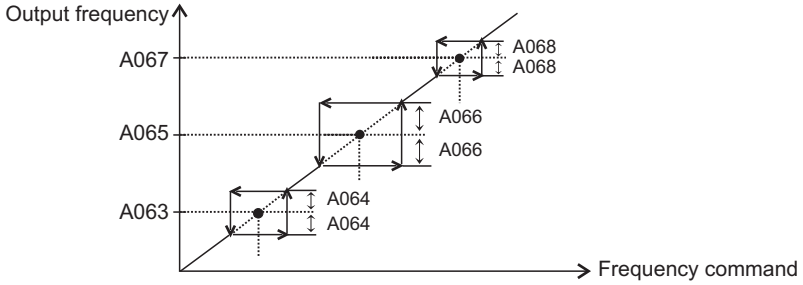
Frequency jump function

Relation code
A063 : Jump frequency 1
A064 : Jump frequency band 1
A065 : Jump frequency 2
A066 : Jump frequency band 2
A067 : Jump frequency 3
A068 : Jump frequency band 3

Frequency jump can be used to avoid resonance points on machinery
Frequency jump is to jump the frequency command and avoid usual operation with the limit of the jump frequency.
Output frequency changes continuously according to adjustable time.
It is possible three different points are set for the jump frequency.

Set item	Function code	Setting limit	Contents
Jump frequency 1/2/3	A063/A065/A067	0.00-400.0	Unit : Hz Set the frequency fj of center to jump.(Note)
Jump width 1/2/3	A064/A066/A068	0.00-10.00	Unit : Hz Set 1/2 value of frequency band to jump.(Note)

(Note) The frequency to jump is fj + 2 (Hz)

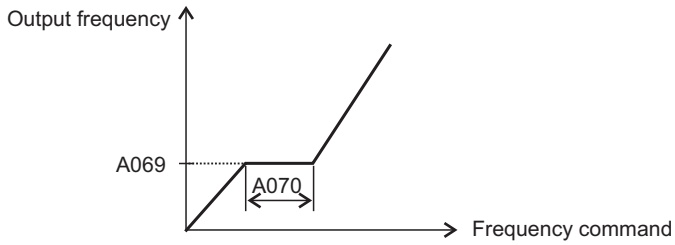


Acceleration stop function

Relation code
A069 : Acceleration stop frequency
A070 : Acceleration stop time

When the intertial moment of a load is high, this is the function to wait until the slip of the motor on starting becomes smaller.
Use when the overcurrent trip occurs on starting.

Set item	Function code	Setting limit	Contents
Acceleration stop frequency	A069	0.00-400.0	Unit : Hz Set the frequency to be held.
Acceleration stop time	A070	0.00-60.00	Unit : Hz Set the time to hold the frequency



Chapter 4 Explanation of function

PID function

This integrated process control function can be used for controls such as constant flow and control for fan and pump applications. When using this function set A071 to 01. Turn off the terminal in the case that you validate this function or turn on the terminal in the case that you invalidate this function after assigned 23 (PID valid/invalid) to intelligent input terminal in the case of switching valid / invalid of this function with the outside signal

Set item	Function code	Data	Contents
PID selection	A071	00	Invalid
		01	Valid
PID P gain	A072	0.2-5.0	Proportional gain
PID I gain	A073	0.0-3600.	Integration Gain Unit : seconds
PID D gain	A074	0.00-100.0	Derivative gain Unit : seconds
PID scale	A075	0.01-99.99	Unit : Times
PID feedback selection	A076	00	O1-L : 4-20mA
		01	O-L : 0-10V
Maximum PID Deviation level	C044	0.00-100.0	Unit : %

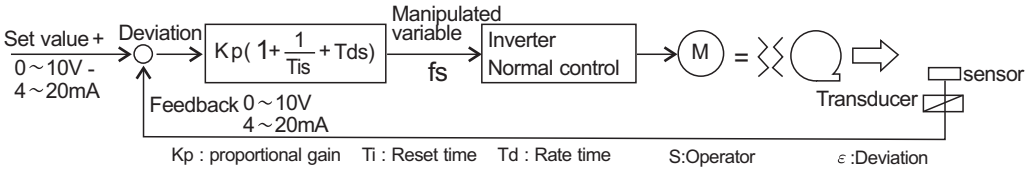
Relation code

A001 : Frequency command selection
A005 : AT selection
A071 : PID selection
A072 : PID P gain
A073 : PID I gain
A074 : PID D gain
A075 : PID scale
A076 : PID feedback selection
d004 : PID feedback monitor
C001-C008 : Intelligent input terminal
C021-C025 : Intelligent output terminal
C004 : PID deviation setting level

(1) Feedback selection

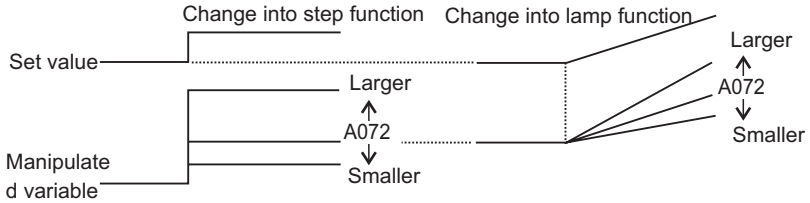
Select which analogue input terminals will be the feedback reference (A076).
Set the set frequency command selection with A001. (In should not be the same as the terminals selected with A076). Or when the control terminal 01 is set with A001, the setting of AT selection A005 is invalid.
The contents changes when 02 is selected with A006.

(2) Basic operation of PID control

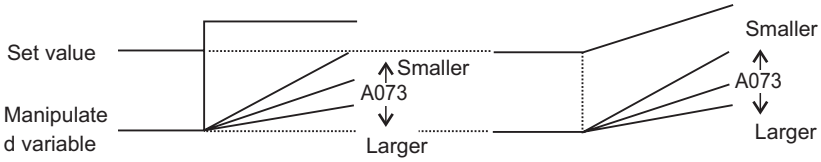


(3) Components of PID

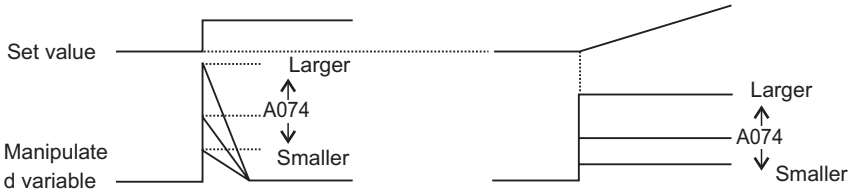
[1] P action This is the action that the manipulated variable is in proportion to the command.



[2] I action This the action that the manipulated variable increases with time in a straight lime.



[3] D action This is the action that the manipulated variable in proportion to the changing rate of command.



PI action combines above [1] and [2], PD action does [1] and [3], PID action does [1], [2] and [3].

Chapter 4 Explanation of function

(4) The adjustment of gain

Please adjust each according to the state as the follosing, when the response on the functional operation PID is not stable.

Inspite of changing command, the change of feedback signal is slow. → Raise P gain
The feedback signal changes instantly but is not stable. → Lower P gain
The command and feedback signal doesn't coincide instantly. → Lower I gain
The feedback signal oscillates and is not stable. → Raise I gain
In spite of raising of P gain, the response is slow. → Raise D gain
When P gain is raised, the feedback signal oscillates and is not stable. → Lower D gain

(5) The Maximum PID Deviation Level / Output

It is possible to establish the maximum deviation level C044 on PID control. When the PID deviation amount reaches the set level C044, it is possible to set an intelligent output.
C044 can be set from 0 to 100 and corresponds with the command : from 0 to maximum.
Assign 04 (OD) to intelligent output terminal 11-15 (C021-C025)

(6) Feedback monitor of PID

Feedback signal of PID can be monitored.
The monitor value can be displayed by the product of PID scale A075.
"Monitor display " = " Feedback (%) × "A075 setting

(7) PID integral reset

This is the function to clear integral value of PID action.
Assign 24(PIDC) to intelligent input terminal.
It is cleared whenever PIDC is turned ON.
Don't turn absolutely ON PID terminal during PID action, because there is a possibility of overcurrent trip.
Turn ON PIDC terminal after turning OFF PID action.

Automatic energy-saving operation function

Relation code

A085 : Operation mode selection
A086 : Energy-saving response-accuracy adjustment

This function regulates the inverter output power automatically to a minimum while operating at constant speed.
This fits for the load of reduced torque characteristic of fans or pumps.
In case of operating by this function, set A085 to "01"
A086 can adjust the automatic operation, response time.

Set item	Function code	Deta	Contents
Operation mode selection	A085	00	Nomal operation
		01	Energy-saving operation

Set item	Function code	Deta	Response	Accuracy
Energy saving response / accuracy adjustment	A086	0 ↕ 100	Slow ↕ Fast	High ↕ Low

Chapter 4 Explanation of function

Two-stage acceleration and deceleration function (2CH)

By setting this function, it is possible to change the rate of acceleration and deceleration .

As methods to change the rate of acceleration and deceleration, you can select the method of changing by i ntelligent input terminal and the method of automatic changing by optional frequency.

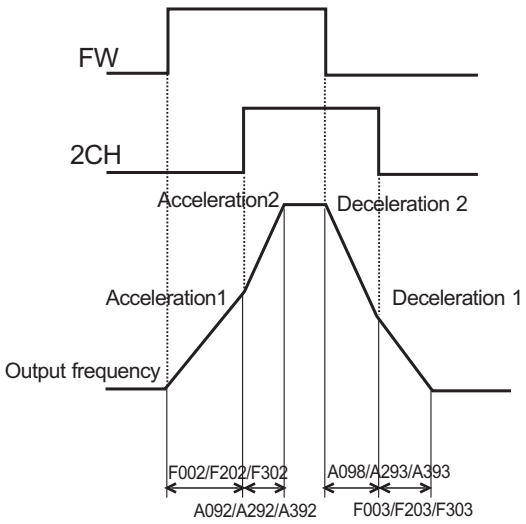
In case of changing by intelligent input terminal, assign 09(2CH) to an Intelligent input terminal.

Relation code

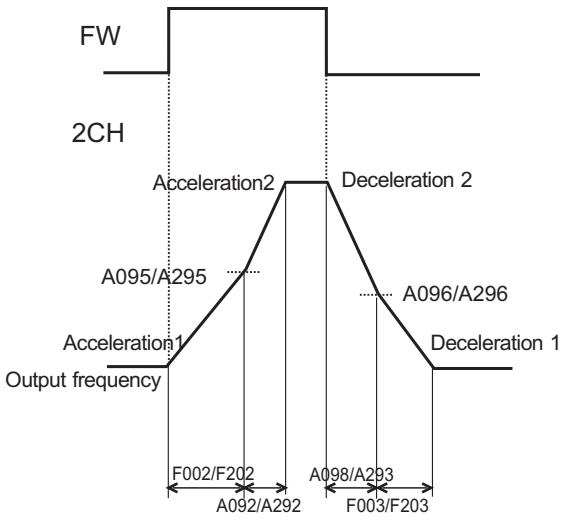
F002/F202/F302 : 1st/2nd/3rd acceleration 1
F003/F203/F303 : 1st/2nd/3rd deceleration time 1
A092/A292/A392 : 1st/2nd/3rd deceleration time 2
A093/A293/A393 : 1st/2nd/3rd deceleration time 2
A094/A294 : 1st/2nd two-stage deceleration and deceleration selection
A095/A295 : 1st/2nd two-stage acceleration frequency
A096/A296 : 1st/2nd two-stage deceleration frequency
C001-C008 : Intelligent input terminal

Set item	Function code	Data	Contents
Acceleration time 2	092/A292/ A392	0.01-3600.	Unit : second (Example 1,2)
Deceleration time 2	093/A293/ A393	0.01-3600.	Unit : second (Example 1,2)
Two-stage acceleration and deceleration selection	A094/A294	00	Changing by intelligent input terminal 09 (2CH) (Example 1)
		01	Chabgung by two-stage acceleration and aeceleration and deceleration frequency (A095/A295, A096/A296) (Example 2)
Twopstage acceleration frequency	A095/A295	0.00-400.0	Unit : Hz it is valid when two-stage acceleration and deceleration selection (A094/A294) is 01. (Example 2)
Two-stage deceleration frequency	A096/A296	0.00-400.0	Unit : Hz it is valid when two-stage acceleration and deceleration selection (A094/A294) is 01. (Example 2)

(Example 1) In to set A094/A294 to 00 case



(Example 2) In to set A094/A294 to 01 case



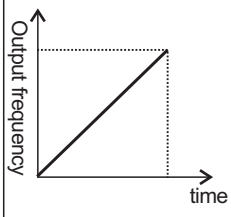
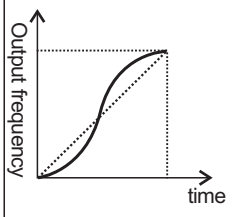
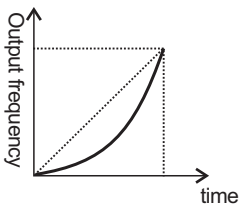
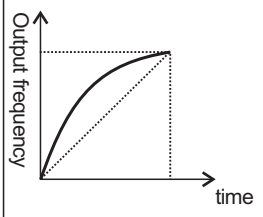
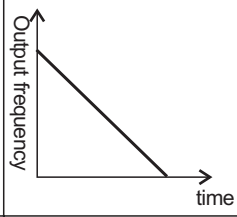
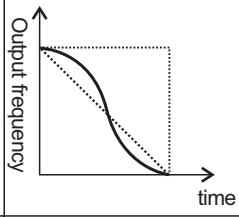
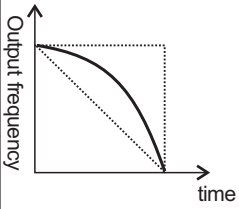
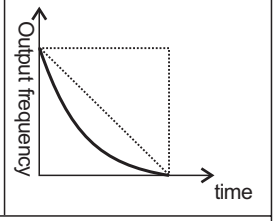
Chapter 4 Explanation of function

Acceleration and deceleration pattern

Relation code
A097 : Acceleration pattern selection
A098 : Deceleration pattern selection
A131 : Acceleration curve constant
A132 : Deceleration curve constant

(1) Selection of pattern

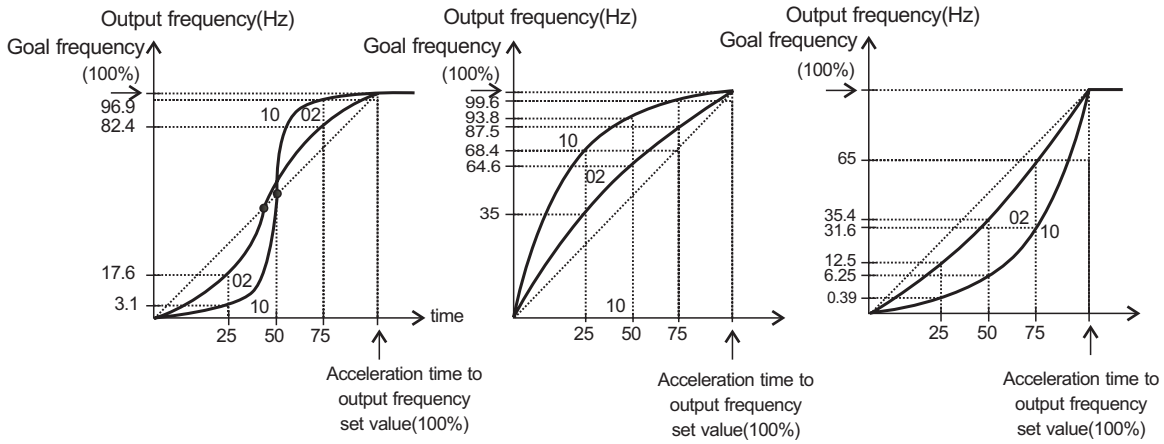
Pattern of acceleration and deceleration speed is possible to set up corresponding to each system. Select the pattern of acceleration and deceleration with A097 and A098.

set value	00	01	02	03
curve	Line	Sigmoid	U-shape	Reverse U-shape
A097 (Accel-eration)				
A098 (Decel-eration)				
Contents	Accelerate and decelerate in line frequency set value	Collapsing the cargo such as the going up and down machine, conveyor it uses it for prevention	Cutting the tension control, rolled book such as the volume collector machine it uses it for prevention	

It is possible to set the pattern of both acceleration, deceleration

(2) The curve constant (the swelling degree)

It makes the rough sketch reference and please decide the swelling degree.



There is the range which the midway adjustable-speed time becomse fast in the S character parrtern.
When An intelligent input terminal is allocated to LAD cancel (LAC) and the terminal is ON, output frequency is immediately controlled by Setup frequency.

Chapter 4 Explanation of function

Instantaneous power failure / under-voltage

Relation code
b001 : Retry selection
b002 : Allowable under-voltage power failure time
b003 : Retry delay time
b004 : Instantaneous power failure under-voltage trip during stop
b005 : Instantaneous power failure under-voltage retry time selection
b007 : frequency setting to match
C021-C002 : Intelligent output terminal
C026 : Alarm relay output

Instantaneous stop and start

(1) You can select whether the inverter trips or retries(restart) when an instantaneous power failure/under-voltage occurs. when retry function is selected with b001, and an instantaneous stop/under-voltage trip occurs restart is tried 16 times and a trip will occur after 17 times.
And when retry function is selected, and an over-current or an over-voltage occurs, restart is tried 3 time and a trip will occur on the forth time. When an instantaneous power failure/under-voltage occurs, you can select execution of trip with b004.
To select a retry function with b001, set the following retry mode correspondent to each system.

Set item	Function code	Data	Description
Retry selection (Note 3)	b001	00	
		01	Restart from 0Hz on retry.
		02	Start equaling frequency on retry. (Example1)
		03	Start f-equaling and stop decelerating on retry. After stop, start trip. (Note1)
Allowable under-voltage power failure time	b002	0.3-1.0	Units : second If the instantaneous power failure time is shorter than the set time, a restart will occur. (Example 1) If the instantaneous stop time is longer than set time, trip. (Example 2)
Retry wait time	b003	0.3-100.	Units : second Delay before motor restart time.
Instantaneous power failure/under-voltage trip during stop (Note 2)	b004	00	Invalid Trip isn't caused and alarm isn't output
		01	Valid Trip is caused and alarm is output
		02	Invalid Trip isn't caused and alarm isn't output during stop and deceleration by stop command.
Instantaneous power failure/under-voltage retry time selection	b005	00	Restart to 16 times on instantaneous stop under-voltage.
		01	restart freely on instantaneous stop under-voltage.
Frequency setting to match	b007	0.00-400.0	Units : Hz When the frequency of the motor during free-run is less than this set frequency, restart with oHz is caused.(Example 3,4)

Chapter 4 Explanation of function

(Note 1) When trip of the over voltage or over current etc.occurs in the deceleration midway an instantaneous power failure error (E16) is displayed and operates free-run. In this case make the deceleration time of long

(Note 2) When using control power supply terminal R0-T0 and connecting DC voltage (P-N) to R0-T0, an under-voltage may be detected at power off and give trip signal. If this may cause any problem to your system, set data in 00 or 02.

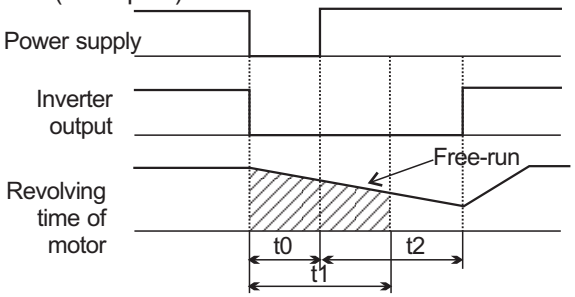
F-equaling start : The inverter reads the motor RPM and direction and restarts the inverter to match these readings. Retry function (b001:02) : The timing chart in case of selection is following.

t0 : Instantaneous stop power failure

t1 : Allowable under-voltage power failure time(b002)

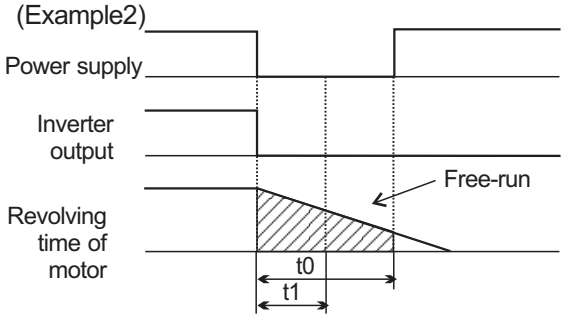
t2: Retry wait time(b003)

(Example1)



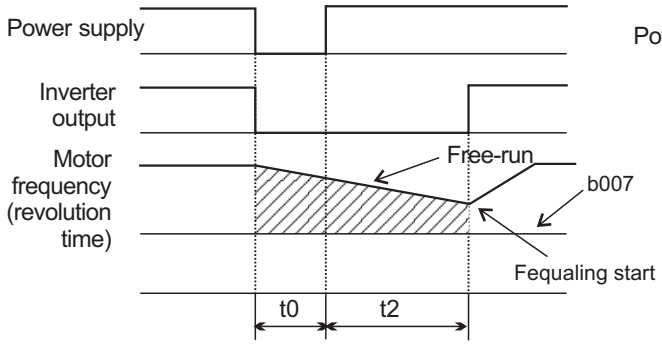
After wait for t2 seconds according to t0<t1, restart.

(Example2)

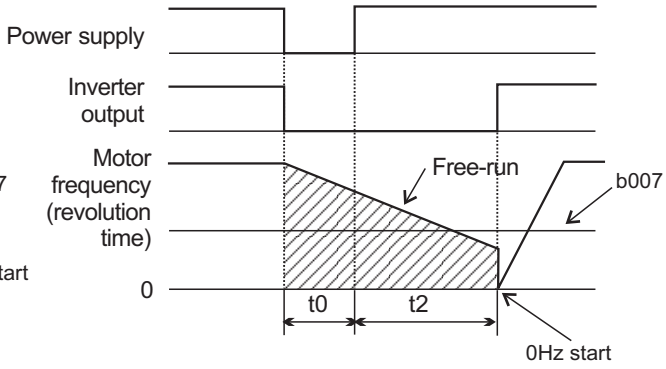


Trip according to t0>t1.

(Example 3) Motor frequency (revolution time) >b007

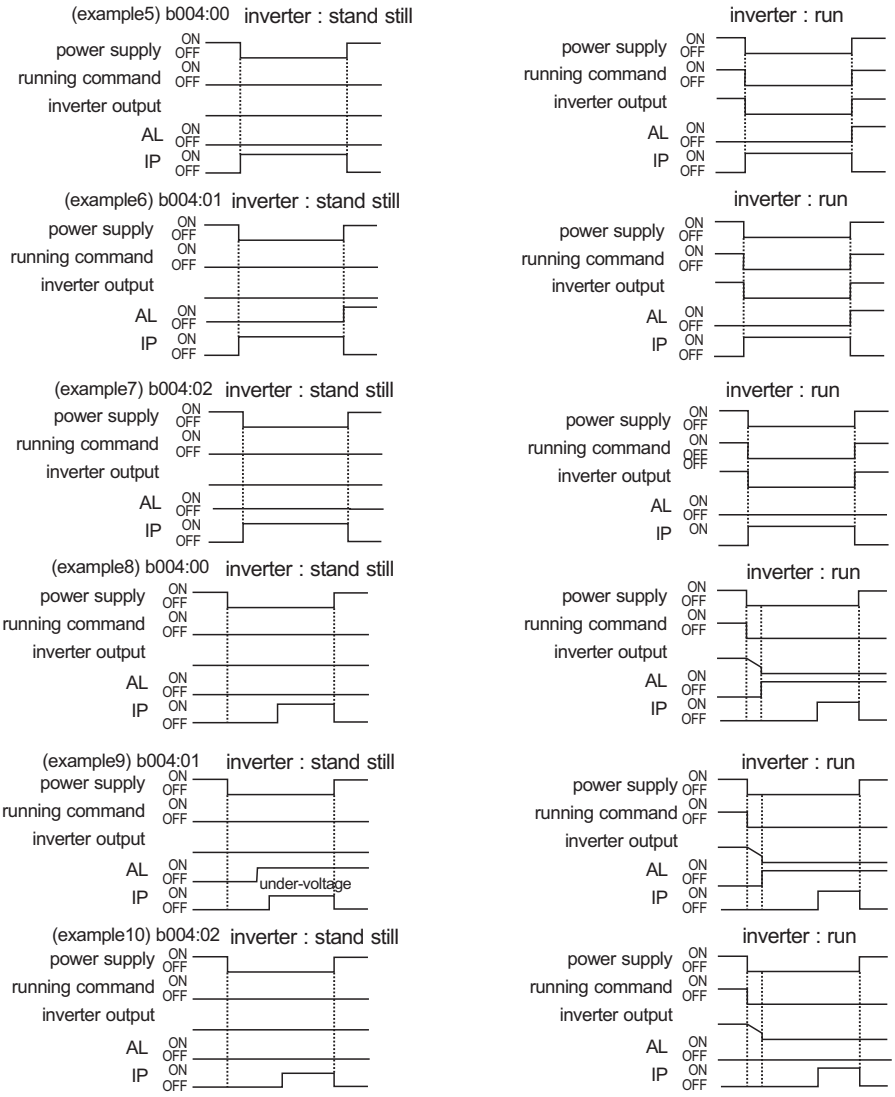


(Example 4) Motor frequency (revolution time) >b007

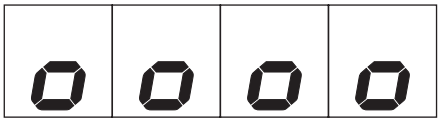


Chapter 4 Explanation of function

(2) Instantaneous power failure during stop alarm output during under-voltage
Select yes/on of alarm output when instantaneous power failure or under-voltage occurs with b004.
Alarm outputs while control power of inverter remains.
・Alarm output at an instantaneous power failure failure and under-voltage during standstill.
Standard (Example 5-7).
Alarm signal performance when connecting DC voltage (P-N) to R0-T0 terminal. (Example 8-10)



(3) It is possible to use an output by assigning the signal (IP:08) during instantaneous stop, by setting (UV:09) during under-voltage to an intelligent output terminal 11-15(C021-C025) or alarm relay output terminal (C026).
(Note 3) It displays as follows during implementing frequency matching.



Chapter 4 Explanation of function

Open phase protection function selection

Relation code
b006 : Open phase selection

This is the function to warn when the inverter input supply opens.

Function code	Data	Description
b006	00	Invalid Don't trip when the input supply opens..
	01	valid Trip when the input supply opens..

When an open phase occurs, there is a danger that the inverter could produce one of the following states:
(1) Ripple current of main capacitor increases, life of main capacitor shortens remarkably.
(2) In case of load, there is danger that the capacitors or thyristors inside the inverter could be damaged.
(3) There is a risk that the in-rush resistor to limit the current inside the inverter may burn out.

Electronic thermal function

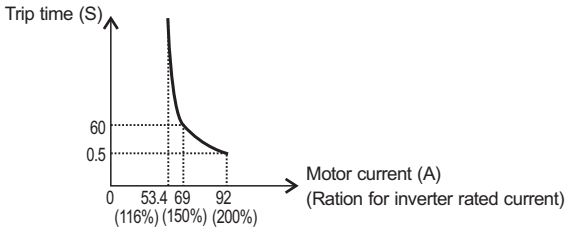
Set the inverter according to motor rated current to protect the motor from overloading, overheating and damage. A warning signal is outputted before tripping on electronic thermal protection.

Relation code
b012/b212/b312 : 1st/2nd/3rd electric thermal level
b013/b213/b313 : 1st/2nd/3rd electric thermal characteristic selection
b015/b017/b019 : free electric thermal frequency 1/2/3
b016/b018/b020 : free thermal current 1/2/3
C021-C025 : Intelligent output terminal
C026 : Alarm relay output terminal
C061 : Thermal warning level

(1) Electronic thermal level

Function code	Setting range	Description
b012/b212 /b312	Rated Current x 0.2 to Rated Current x 1.2	Units : A

(Example) N300-110LF
Motor current : 46A
Setting range : 9.2 to 55.2A
When electronic thermal level b012=46A time limit characteristic is right diagram.

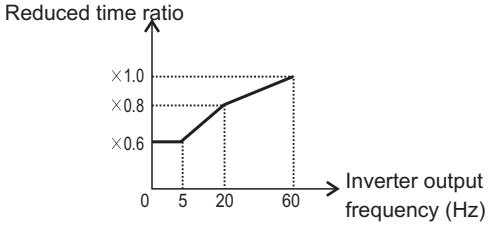


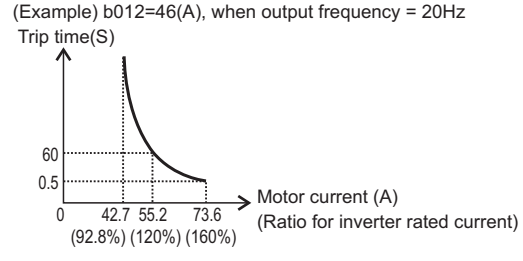
(2) Electronic thermal characteristic
Frequency characteristic is added up to set value of b012.

Function code	Data	Electronic thermal characteristic
b013/b213/ b313	00	Reduced torque characteristic
	01	constant torque characteristic
	02	Free setting

When output frequency of general motor decreases cooling function of self-cooled fan will fall.
Reduced torque characteristic is calculated according to heat of an HYUNDAI general motor.

(a) Reduced torque charcteristic
To add the time limit characteristic set with the reduced time rate b012/b212/b312 by each frequency.

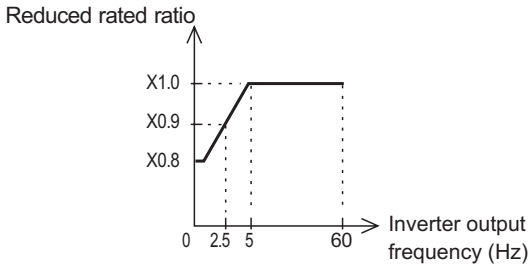


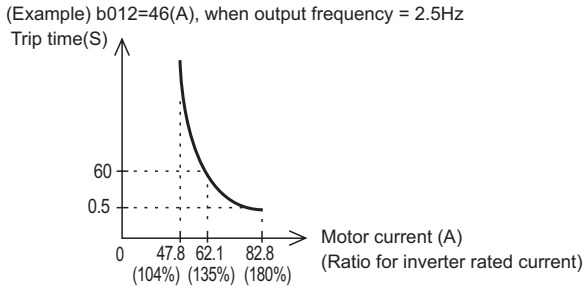


Chapter 4 Explanation of function

(b) Constant torque characteristic

Set this in to use constant torque motor case.



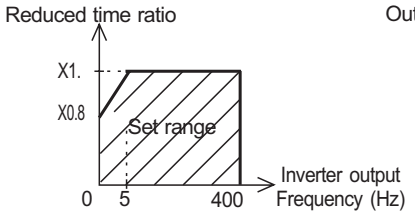


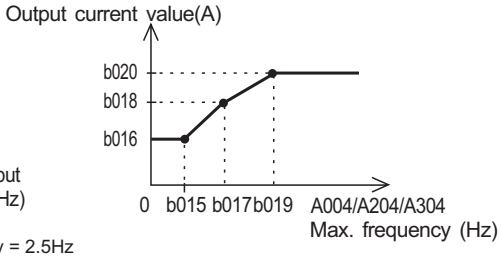
(3) Free/thermal characteristic

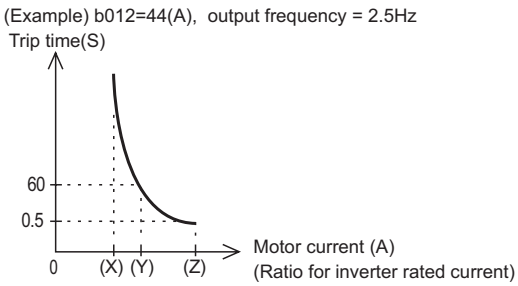
It is possible to set the electronic thermal characteristic freely according to the load in order to protect the motor and the Inverter.

Setting range is shown as follows :

Set item	Function code	Set range	Description
Free electronic thermal frequency 1/2/3	b015/b017/b019	0 to 400	Units : Hz
Free electronic thermal current 1/2/3	b016/b018/b020	0.0 0.1 to 999.9	disable Units : A







(x) : b018 x116%
(y) : b018x120%
(z) : b018x150%

(4) Thermal warning

A warning signal is outputted before overheat protection by the electronic thermal protection occurs.

Warning level is set with C061.

Assign 13(THM) to intelligent output terminal (C021-C025) or the alarm relay output (C061).

Function code	Data	Description
C061	0. 1.-100.	Thermal warning is noneffectiv. Units : %

Chapter 4 Explanation of function

Overload restriction/Overload advance notice

Relation code

b021:Overload restriction selection
b022:Overload restriction level
b023:Overload restriction constant
b024:Overload restriction 2 selection
b025:Overload restriction level 2
b026:Overload restriction constant 2
C001-C008:Intelligent input
C021-C025:Intelligent output
C026:Alarm relay output setting
C040:Overload advance notice signal output mode
C041:Overload notices level
C111:Overload notices level2

(1) Overload restriction

The Inverter monitors the motor current on acceleration and constant speed, when the inverter reaches the overload restriction level, the Inverter will reduce the output frequency automatically to restrict the overload.

This function prevents an over-current trip by inertia during acceleration or radical changes in load at constant speed.

Two kinds of overload restriction function are set with b021, b022, b023 and b024, b025, b026. To change b021, b022, b023, and b024, b025, b026, assign 39(OLR) to an intelligent input terminal.

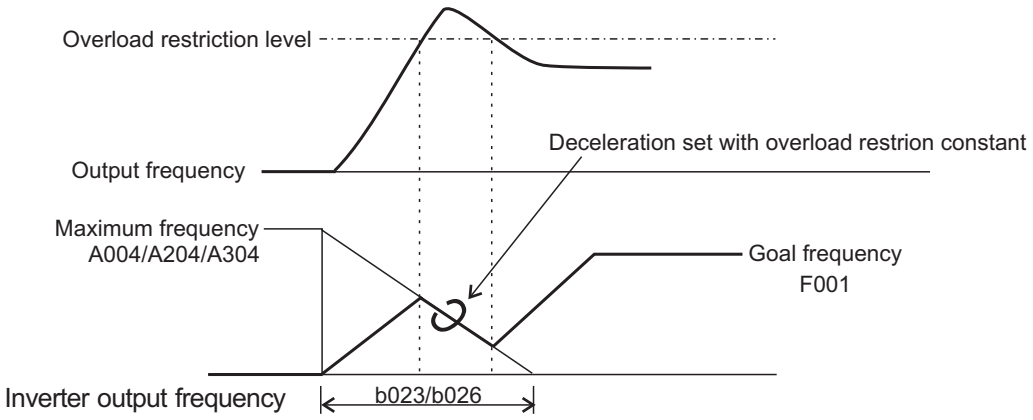
The current value this function operates at is set in overload restriction level. The overload restriction constant is the time to decelerate to 0Hz from max frequency. b021, b022, b023 and b024, b025, b026 is changed with OLR. As this function operates, the acceleration time is longer than setting time.

If the overload restriction constant is set too short, in spite of accelerating, an over-voltage trip is caused with regenerative enegy from the motor on automatic deceleration by this function. When this function operates in the midst of accelerating, the frequency will not reach the goal frequency, the Inverter will adjust in the following way.

Make acceleration time longer.
Raise torque boost.
Raise overload restriction level.

Set item	Function code	Data	Description
Overload restriction Selection	b021/b024	00	Invalid
		01	Acceleration/valid on constant speed.
		02	Valid on constant speed.
		03	Acceleration/valid on constant speed. (Note1)
Overload restriction Level.	b022/b025	Rated current x 0.5 to Rated current x 2.0	Units :A Current value overload restriction operates.
Overload restriction Constant.	b023/b026	0.1 to 30.0	Units :second Deceleration time when overload restriction Operates.

(Note 1) Increase speed mode at the time regenating

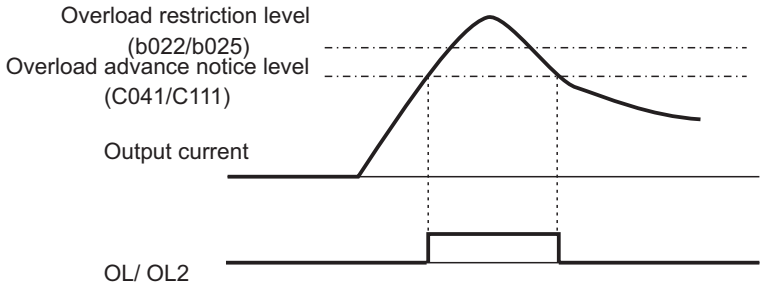


Chapter 4 Explanation of function

(2) Overload advance notice

When the load is high, it is possible to adjust the again by outputting an overload advance notice.
It is used to prevent damage to the machine from too much load, i.e. baggage on a conveyor, the Inverter overload protection will operate.
Assign 03(OL) or 26(OL2) to an intelligent output terminal 11-15 or the alarm relay output terminal.
(Two kinds of overload advance notice signals are possible output.)

Set item	Function code	Data	Description
Overload advance notice signal output mode selection	C040	00	On acceleration/deceleration, constant speed, this is valid.
		01	On constant speed only, this is valid.
Overload advance notice Level	C041	0.0	Overload advance notice is non-effective.
		0.1 to Rated current x 2	Units : A As load reaches overload advance notice level. OL signal is output.
Overload restriction Constant.	C111	0.0	Overload advance notice 2 is non-effective.
		0.1 to Rated current x 2	Units : A As load reaches overload advance notice level. OL2 signal is output.



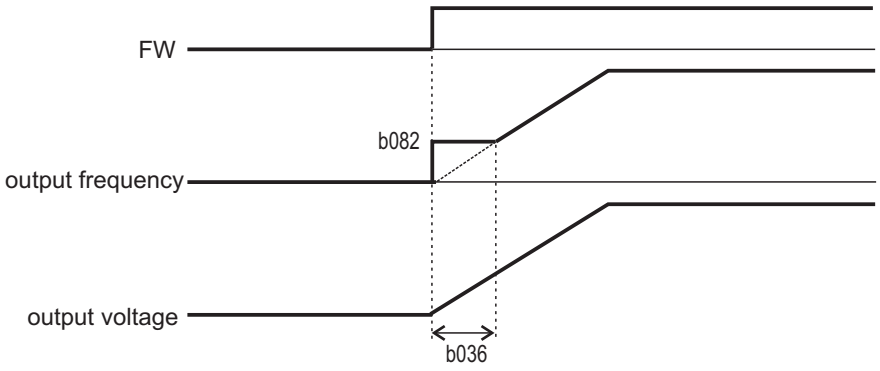
Chapter 4 Explanation of function

Start frequency

Relation code
b082:Start frequency

This frequency is the value the operator must set before the Inverter will give an output.
Mainly used when an operator adjusts the start torque.
By setting the start frequency higher, direct starting is caused and the starting current increases.
Therefore an overload is within the restriction range and the inverter has a tendency to trip on over-current protection

Function code	Set range	Description
b082	0.10 ~ 9.99	Units : Hz

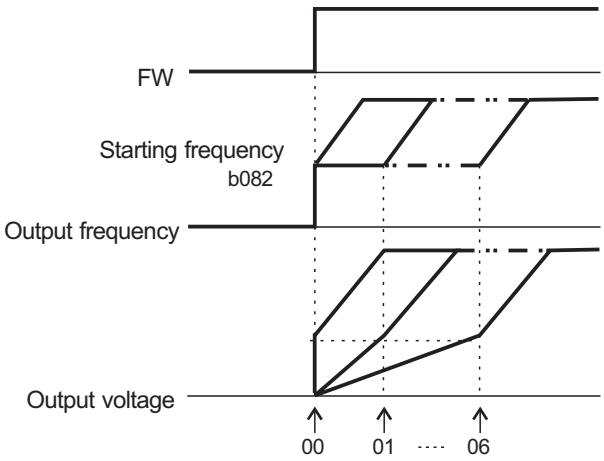


Reduced voltage start selection

Relation code
b036:Reduced voltage start selection
b082:Start frequency

This function is to raise the voltage slowly on motor starting.
The lower this value the mote torque is available on starting.
However, by making this value lower, the inverter has a tendency of tripping on over-current protection, because of almost direct starting.

Function code	Data	Time to take for reduced voltage starting
b036	00	No reduced voltage start
	01 ↕ 06	Short (about 6ms) ↕ Long (about 36ms)

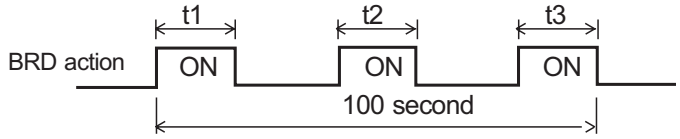


Chapter 4 Explanation of function

BRD (dynamic braking) function

Relation code
b090:BRD use
b095:BRD action selection
b096:BRD on level

This function only operates with the N300-11kW and lower, as they have the built-in BRD.
This function is to consume regenerative energy from the motor as heat by the use of an external resistor.
Regeneration occurs when the motor is decelerated to quickly and the motor turns into a generator and voltage flows back into the inverter.
To use the BRD function, set following condition.

Set item	Function code	Data	Description
BRD usage Ratio	b090	0.0	BRD don't operate.
		0.1-100.0	The usage ratio of BRD is set by 0.1% unit When inverter exceeds the usage ratio, trip.  $\text{Usage ratio}(\%) = \frac{(t1+t2+t3)}{100\text{second}} \times 100$
Selection of BRD	b095	00	BRD don't operate.
		01	During run : valid (BRD operates.) During stop : invalid (BRD desn't operate.)
		02	During run, stop, valid (Brd operates.)
BRD ON Level	b096	(Note 1) 330-380	Unit : V In case of 200V class inverter, setting is valid.
		(Note 1) 660-760	Unit : V In case of 400V class inverter, setting is valid.

(Note 1) BRD ON level is the voltage setting of the DC (direct current) voltage of the inverter.

Cooling fan operating selection

Relation code
b092:Cooling fan operation selection

You can select whether the fan operates continuously or operates only when the inverter is in the running operation.

Function code	data	Description
b092	00	Always run
	01	Only during run However, inverter operates for five minutes after power ON, and for five minutes after inverter operation stops.

Chapter 4 Explanation of function

Intelligent input terminal setting

Relation
C001～C008 :
Intelligent input terminal

It is possible to operate functions by assigning those functions to the intelligent input terminals 1-8(C001-C008).
The intelligent input terminals 1-8 can be selected individually whether the contact input specification is either a NO or a NC contact.
Two or more intelligent input terminals can't be assigned to be the same function.
If an intelligent input is assigned a function which is already assigned to another terminal it will automatically be restored back to the setting before.

Function Code	Data	Description	Reference item	Page
C001 ～ C008	01	RV : Reverse command	Operation run	4-18
	02	CF1 : Multi-speed 1 (binary operation)	Multi-speed operation function	4-46
	03	CF2 : Multi-speed 2 (binary operation)		
	04	CF3 : Multi-speed 3 (binary operation)		
	05	CF4 : Multi-speed 4 (binary operation)		
	06	JG : Jogging	Jogging operation	4-48
	07	DB : External DC braking	DC braking(ezternal DC braking)	4-29
	08	SET : 2nd Set of Motor Data	2nd Set of Motor Data	4-49
	09	2CH : Two-stage adjustable-speed	Two-stage adjustable-speed function	4-35
	11	FRS : Free-run stop	Free-run stop	4-51
	12	EXT : External trip	External trip	4-55
	13	USP : Unattended start protection	Unattended start protection function	4-54
	14	CS : Commercial change	Commercial change	4-52
	15	SFT : Software lock(control terminal)	Software lock	4-50
	16	AT : Analog input voltage/current select	Analog external input	4-22
	17	SET3 : 3rd Set of motor data	3rd Set of Motor Data	4-49
	18	RS : Reset inverter	Reset inverter	4-53
	20	STA : 3wire start	3wire input function	4-55
	21	STP : 3wire stop		
	22	F/R : 3wire direction		
	23	PID : PID selection (valid/invalid)	PID function	4-33
	24	PIDC : PID integrating reset		
	26	CAS : Control gain switching	Control gain switching	4-56
	27	UP : Remote control UP function	UP/DOWN function	4-54
	28	DWN : Remote control DOWN function		
	29	UDC: Remote control data clear		
	31	OPE : Force operation ope	Force operation function	4-50
	32-38	SF1-7 : Multi-speed 1~7(bit run)	Multi-speed operation function	4-47
	39	OLR : Overload restriction change	Overload restriction	4-41
	40	TL : Torque restriction presence	Torque limit function	4-79
	41	TRQ1 : Torque limit switching 1		
	42	TRQ2 : Torque limit switching 2		
	43	PPI : P/PI switching	P/PI switching function	4-56
	44	BOK : Brake confirmation	Brake control function	4-69
	45	ORT : Orientation	Option function (Note 1)	—
	46	LAC : LAD cancel	LAD cancel function	—
	47	PCLR : Position deviation clear	Option function (Note 1)	—
	48	STAT : Pulse train input permission		
	no	NO : No assign	—	—

(Note 1) Refer to the option instruction manual (N-FB)

Chapter 4 Explanation of function

Input terminal a/b(NO/NC)selection

It is possible to set a contact input or b contact input to intelligent input terminals 1-8 and FW terminals individually.

Set item	Function code	Data	Descripition
Intelligent input 1-8 a/b(ON/NC) selection	C011-C018	00	a contact (ON)
		01	b contact (NC)
Input FW a/b(ON/NC) selection	C019	00	a contact (ON)
		01	b contact (NC)

Relation code

C011～C018 : Intelligent input a/b(NO/NC) selection
C019 : Input FW a/b (NO /NC)Selection

a contact : 「ON」 with Close,「OFF」 with open
b contact : 「ON」 withOpen, 「OFF」 with close
RS terminal can set only a contact

Multi-speed operation function

It is possible to set multiple operation speeds and switch between the speed with the terminals.
Multi-speed operation can be selected by binary operation (max.16speeds)with 4 terminals or by bit operation (max.8 speeds) with 7 terminals.

Relation code

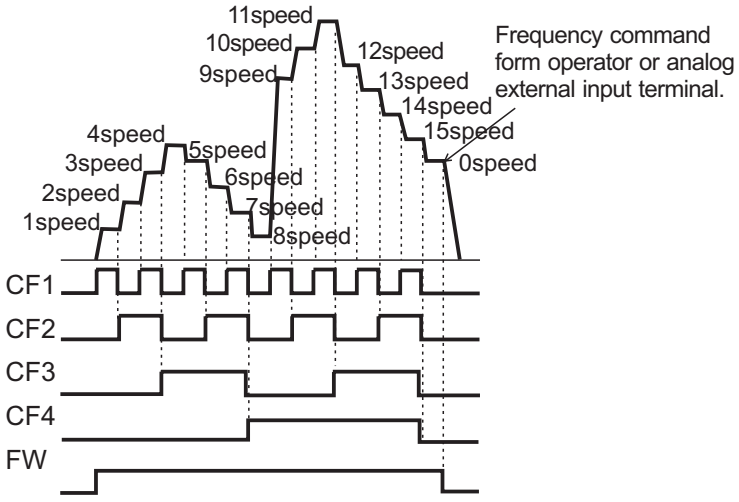
A019 : Multi-speed selection
A020/A220/A320 : 1st/2nd/3rd multi-stage speed zero speed
A021～A035 : Multi-speed 1-15
C001～C008 : Intelligent input terminal

Set item	Function code	Set value	Description
Multi-speed selection	A019	00	Change to binary operation 16 speed
		01	Change to bit operation 8 speed
Multi-speed 0-15	A020/A220/A320 -A035	0.00, start frequency-max. frequency	Units : Hz

(1) Binary operation

It is possible to set multi-speed 0 to 15 by selecting 02 to 05(CF1 to CF4) on the intelligent input terminals.
Set frequency setting for speed 1 to 15 with A021-A035.
Set 0 speed with A020/A220/A320 or F001 when frequency command is operator.
Or when frequency command is control terminal (Terminal), set with O, O1, O2 terminal.

Multi-speed	CF4	CF3	CF2	CF1
0 speed	OFF	OFF	OFF	OFF
1 speed	OFF	OFF	OFF	ON
2 speed	OFF	OFF	ON	OFF
3 speed	OFF	OFF	ON	ON
4 speed	OFF	ON	OFF	OFF
5 speed	OFF	ON	OFF	ON
6 speed	OFF	ON	ON	OFF
7 speed	OFF	ON	ON	ON
8 speed	ON	OFF	OFF	OFF
9 speed	ON	OFF	OFF	ON
10 speed	ON	OFF	ON	OFF
11 speed	ON	OFF	ON	ON
12 speed	ON	ON	OFF	OFF
13 speed	ON	ON	OFF	ON
14 speed	ON	ON	ON	OFF
15 speed	ON	ON	ON	ON



Chapter 4 Explanation of function

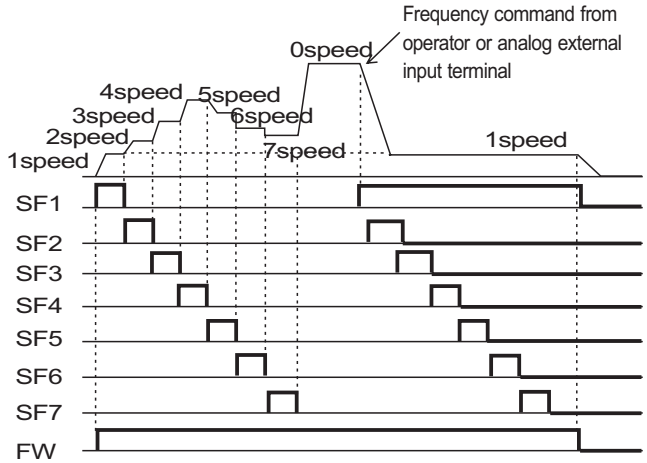
(2) Bit operation

It is possible to set multi-speed 0 to 7 by assigning 32 to 38 (SF1-SF7) to the intelligent input terminals. Set frequency SF1-SF7 to A021-A027.

Multi-speed	SF7	SF6	SF5	SF4	SF3	SF2	SF1
0 speed	OFF	OFF	OFF	OFF	OFF	OFF	OFF
1 speed	X	X	X	X	X	X	ON
2 speed	X	X	X	X	X	ON	OFF
3 speed	X	X	X	X	ON	OFF	OFF
4 speed	X	X	X	ON	OFF	OFF	OFF
5 speed	X	X	ON	OFF	OFF	OFF	OFF
6 speed	X	ON	OFF	OFF	OFF	OFF	OFF
7 speed	ON	OFF	OFF	OFF	OFF	OFF	OFF

When each terminal turns ON simultaneously, the lower number has priority.

In order for the inverter to operate both the frequency and the RUN operation (FW, RV) must be applied.



Chapter 4 Explanation of function

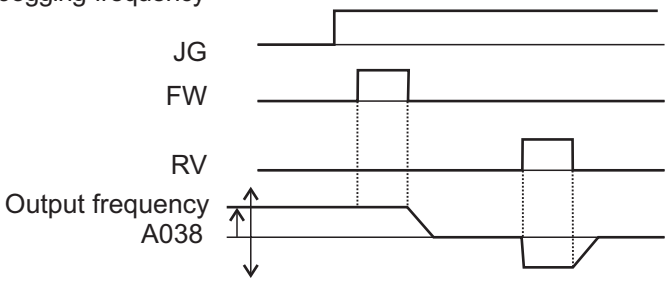
Jogging operation (JG)

Relation code

A038 : Jogging frequency
A039 : Jogging selection
C001-C008 : Intelligent input terminal

This function can be used to rotate the motor in small steps to allow fine-tuning.
Set an intelligent input terminal to 06 (JG).

(1) Jogging frequency



The jogging operation does not use acceleration, therefore it would be advisable to set the jogging frequency to limit the starting current to a minimum or tripping may occur. Adjust A038 to the jogging frequency required.

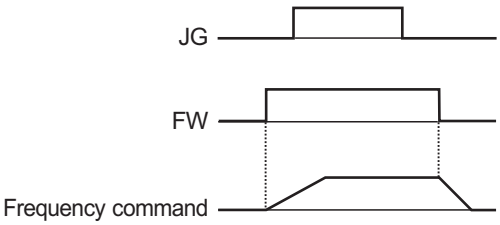
Function code	Data	Description
A038	0.0, start frequency-9.99	Units : Hz

(2) Jogging operation selection

Function code	Data	Description	Jogging operation during run Valid / Invalid
A039 (Note 2)	00	Freeprun on jogging stop	Invalid (Example 1) (Note 1)
	01	Decelerating stop on jogging stop	
	02	Direct braking on jogging stop.	
	03	Free-run on jogging stop	Invalid (Example 2) (Note 1)
	04	Decelerating stop on jogging stop	
	05	Direct braking on jogging stop.	

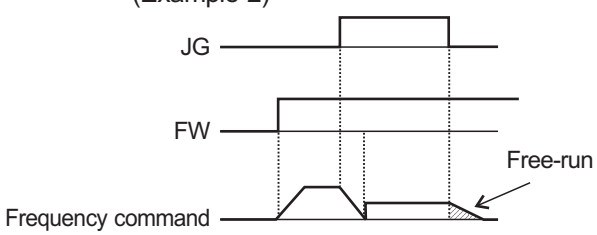
(Note 1) When using the jogging function, turn FW terminal or RV terminal ON after the JG terminal is turned ON. (It is the same when the operation command point is from the operator)

(Example 1)



When setting of A039 is 00,01 or 02 and FW signal is turned ON beforehand, the inverter doesn't operate jogging.

(Example 2)



When setting of A039 is 03,04 or 05 and FW terminal is turned ON beforehand, the inverter operates jogging. But jogging terminal is turned ON beforehand, the inverter output is cut off.

(Note 2) In the case that the setting of A029 is 02 or 05, data setting of DB is necessary.

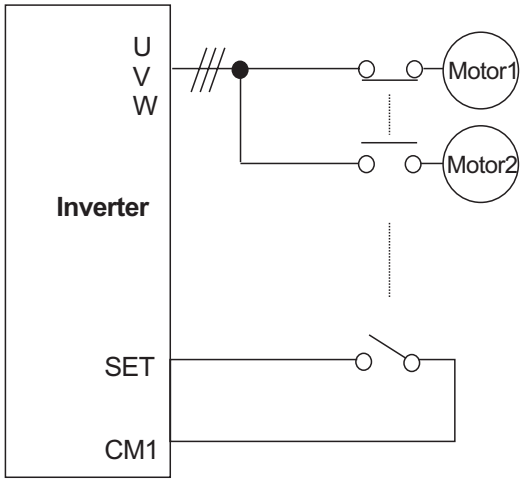
Chapter 4 Explanation of function

Second/Third control function (SET, SET3)

This control function is used when the Inverter is connected to two different types of motors. By assigning 08 (SET).17(SET3) to an intelligent input terminal and turning SET/SET3 terminal ON/OFF you can switech between three different inverter set-ups.

select 2nd/3rd control function while the Inverter is in the STOP condition.

The functions which can change with SET terminal



F002/F202/F302 : 1st/2nd/3rd acceleration time
F003/F203/F303 : 1st/2nd/3rd deceleration time
A003/A203/A303 : 1st/2nd/3rd base frequency
A004/A204/A304 : 1st/2nd/3rd max. frequency
A020/A220/A320 : 1st/2nd/3rd multi-speed 0 setting
A041/A241 : 1st/2nd torque boost selection
A042/A242/S342 : 1st/2nd/3rd manual torque boost
A043/A243/A343 : 1st/2nd/3rd manual torque boost point
A044/A244/A344 : 1st/2nd/3rd control system
A061/A261/A361 : 1st/2nd/3rd frequency upper limiter
A062/A262/A362 : 1st/2nd/3rd frequency lower limiter
A092/A292/A392 : 1st/2nd/3rd acceleration time 2
A093/A293/A393 : 1st/2nd/3rd deceleration time 2
A094/A294 : 1st/2nd two-stage adjustable speed selection
A095/A295 : 1st/2nd two-stage acceleration frequency
A096/A296 : 1st/2nd two-stage deceleration frequency
b012/b212/b312 : 1st/2nd/3rd electronic thermal level
b013/b213/b313 : 1st/2nd/3rd electronic thermal characteristic selection
H002/H202 : 1st/2nd motor constant selection
H003/H203 : 1st/2nd motor capacity selection
H004/H204 : 1st/2nd motor pole selection
H005/H205 : 1st/2nd speed answer
H006/H206/H306 : 1st/2nd/3rd stabilized constant
H020/H220 : 1st/2nd Motor R1
H021/H221 : 1st/2nd Motor R2
H022/H222 : 1st/2nd Motor L
H023/H223 : 1st/2nd Motor I_0
H024/H224 : 1st/2nd Motor J
H030/H230 : 1st/2nd Motor R1 (Auto-tuning)
H031/H231 : 1st/2nd Motor R1 (Auto-tuning)
H032/H232 : 1st/2nd Motor L (Auto-tuning)
H033/H233 : 1st/2nd Motor I_0 (Auto-tuning)
H034/H234 : 1st/2nd Motor J (Auto-tuning)
H050/H250 : 1st/2nd PI proportion gain
H051/H251 : 1st/2nd P proportion gain
H060/H260 : 1st/2nd Zero SLV limitter

Display during setting isn't differentiated between the 1st control function or the 2nd /3rd control function function. So confirm it in the state of ON/OFF of termnal. Even 1st/2nd/3rd control is changed during run, it will not be active until the inverter is stopped. When both of the SET and SET 3 terminals are turned on it becomes the 2nd control function.

Chapter 4 Explanation of function

Software lock mode selection (SET)

Relation code

b031 : Software lock mode selection
C001-C008 : Intelligent input terminal

This function is used to prevent changing data by mistake.
When you want to use an intellignent input terminal, assign 15(SFT).
Below is the software lock code selection.

Function code	Data	SFT terminal	Description
b031	00	ON/OFF	Write disable except for b031/write enable
	01	ON/OFF	Write disable except for b031, F001, A020, A220, A320 A021-A035,A038/write enable
	02	—	Write disable except for b031
	03	—	Write disable except for b031, F001, A020, A220, A320,A021-A035,A038
	10	—	Write disable except for change mode during runnuing (code list reference)

Force operation ope function (OPE)

Relation code

A001 : Frequency setting selection
A002 : Operation command selection
C001-C008 : Intelligent input terminal

This function is used to operate from the operator forcibly by on/off of an intelligent terminal when frequency and operation command is selected other than the operator.
Becoming the operation from the frequency and operation command that was selected by A001 and A002 if the signal is off, and becoming the frequency and operation command from an operator forcibly if the signal is on when the compulsion operation function is selected by an intelligent input selection.
When changed the operation command while driving, operation command is canceled and become stoppage at first.
Operation command from each command input the operation command once again as the stoppage at first for driving once again.

Set item	Function cord	Setting value	Contents
Frequency setting selection	A001	01 02 03 04 05	Terminal Operator RS485 Option 1 Option 2
Operation command selection	A002	01 02 03 04 05	Terminal Operator RS485 Option 1 Option 2
Intelligent input selection	C001-C008	31	OPE : Compulsion operation

Chapter 4 Explanation of function

Free-run stop (FRS)

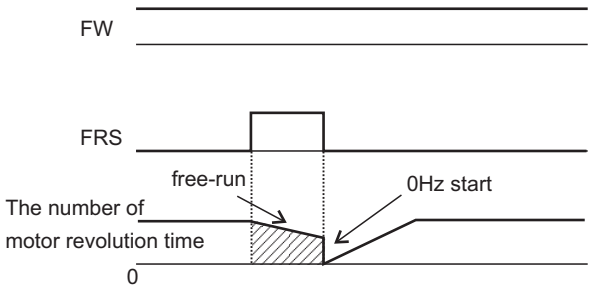
Relation code

b088 : Free-run stop selection
b003 : Retry wait time
b007 : Frequency setting to match
b091 : Stop mode selection
C001-C008 : Intelligent input terminal

By operating the free-run stop (FRS) function, the inverter output is cut off. The motor wills free wheel under its own mometum.
This function is used when the motor is to be stopped by the use of a brake, like an electromagnetic brake.
If you stop the motor with a machine brake while the inverter is still outputting ti the motor an over-current trip may occur.
Assign 11(FRS) to an intelligent input terminal.
This free-run stop function will operate when the FRS terminal is ON.
If you turn FRS terminal OFF the inverter will restart after the retry wait time b003 passes.
However when the operation command selection A002 is set to control terminal (01), the inverter restarts during free-running.
This function will only operate when the FW terminal is ON.
On restart it is possible to select 0Hz start or matching frequency start as output methods with the free-run stop selection b088. (Example 1), (Example 2)
When you set the frequency setting to match (b007) and the frequency detected is under this setting when the free-run stop is released, the inverter is restarted from 0Hz.
The setting of this function is valid for selection b091 on stopping.

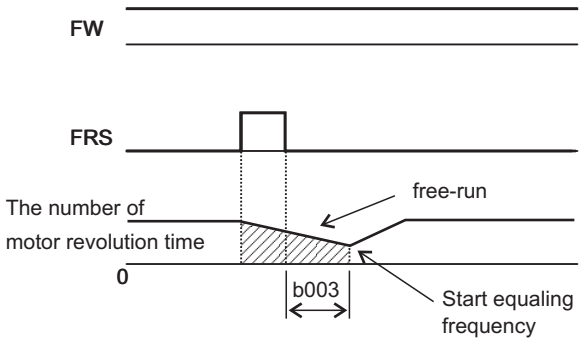
Set item	Function code	Data	Description
Free-run stop selection	b088	00	0Hz start (Example 1)
		01	Equaling frequency start (Example 2)
Retry wait time	b003	0.3-100.	Units : second Time until restart after FRS terminal is OFF. (This is also used for Instantaneous restart.)
Frequency setting to match	b007	0.00-400.0	Units : Hz (instantaneous stop, reference to item of insufficiency) This sets the level to match frequency. (Refer to item of instantaneous stop and restart).

(Example 1) 0Hz start



Start 0Hz regardless of the motor speed.
On 0Hz start, the retry wait time is disregarded.
When 0Hz start is used and the motor speed is still high there is the possibility of over-current trips.

(Example 2) Equaling start



After FRS terminal is switched OFF, the Inverter reads the frequency of the motor and when it reaches the value in b007 the Inverter will begin to RUN again.
On frequency matching start if an over-current trip occurs, try extending the retry time.

Chapter 4 Explanation of function

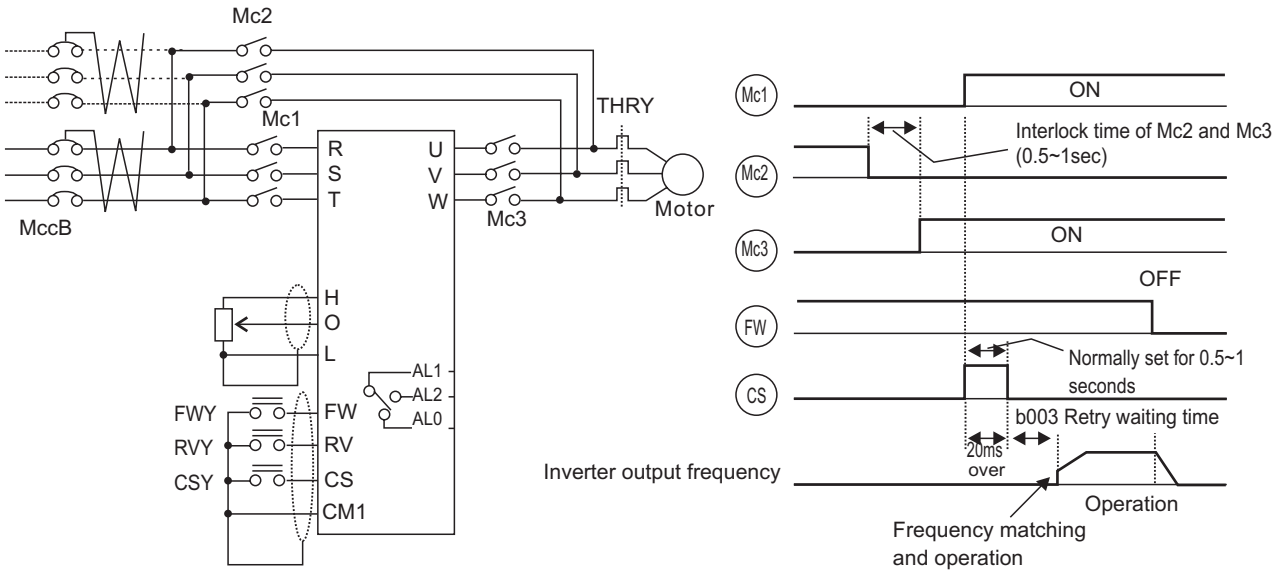
Commercial power source switching (CS)

Relation code
b003 : Retry waiting time
b007 : Frequency setting to match
C001-C008 : Intelligent input terminal

This function is used for systems with an excessive amount of staring torque requirements. The motor would be started direct-on-line and then when the motor had started the inverter would take over. This function is comonly used to reduce the costing of the inverter. For example, a system may require 55kW to start but only 15kW to run at constant speed. Therefore, a 15kW rated inverter would be sufficient when using te commercial power sorce switing. Assign 14(CS) to an intelligent input terminal.
Using the example below. When the motor has ben started direct-on0line, Mc2 is switched OFF and Mc3 is switched on. With the Forward command to the inverter already on the CS terminal is switched on and Mc1 is closed. The inverter will then read the motor RPM and when the CS terminal is switched OFF the retry wait time (b003) is started.
Once the wait time has elapsed the inverter will then start and match the frequency which is set (b007).
For FWY, RVY, VSY, use control relay. The sequence above is reference to circuit and timing diagram below.

If an over-current trip occurs when frequency matching, extend the retry wait time (b003).
When the power is supplied to the inverter, also it is possible to activate retry operation too. In this case, follwing CS terminal is out of necessary. For more information, refer to Reset (RS).

Connection figure example and timing on commercial power source switching.



Chapter 4 Explanation of function

Reset (RS)

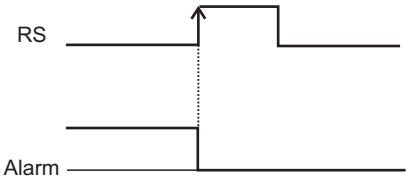
Relation code

b003 : Retry waiting time
b007 : Frequency setting to match
C102 : Reset selection
C103 : Reset frequency matching selection
C001-C008 : Intelligent input terminal

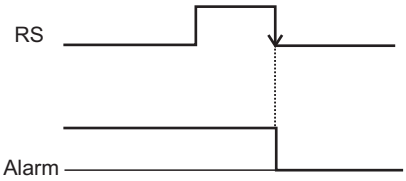
This function resets the inverter when a protective trip has occurred. The method of reset is to either push the STOP/RESET key on the digital operator or to switch the RS terminal ON.
To reset the inverter with the control terminal, assign 18(RS) to an intelligent input terminal.
Reset frequency matching selection C031 selects whether the inverter restarts at 0Hz or the inverter matches the output frequency after the reset operation is complete.
Reset selection C102 selects when the alarm signal is cancelled and whether it is valid or invalid in normal operation.
The RS terminal is valid only when the contact is set to ON.

Set item	Function code	Data	Description
Retry waiting time	b003	0.3-100.	Units : seconds (Reference to items of instantaneous power failure or under-voltage) After reset, time until restart is tried.
Frequency setting to match	b007	0.00-400.0	Units : Hz (Reference to items of instantaneous stop/under-voltage)
Rest selection	C102	00	On ON signal, trip cancel (Example 1) On normal, this is valid (output cuts off)
		01	On ON signal, trip cancel (Example 2) On normal, valid (output cuts off)
		02	On ON signal, trip cancel (Example 1) On normal, this is invalid. (only trip cancel)
Rest frequency matching selection	C103	00	0Hz start
		01	Frequency matching start. (Example 3)

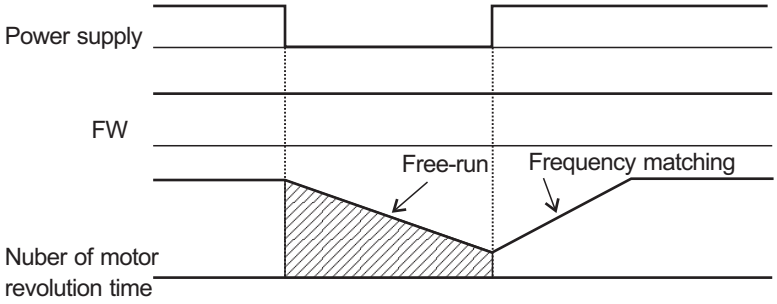
(Example1)



(Example2)



(Example 3) When 01 (frequency matching) is selected with reset frequency matching selection C103, it is also possible to operate frequency start on power ON again. And retry waiting time is disregarded at the time of the setting C103:00 (0Hz start).



Chapter 4 Explanation of function

Unattended start protection (USP)

Relation code
C001-C008 : Intelligent input terminal

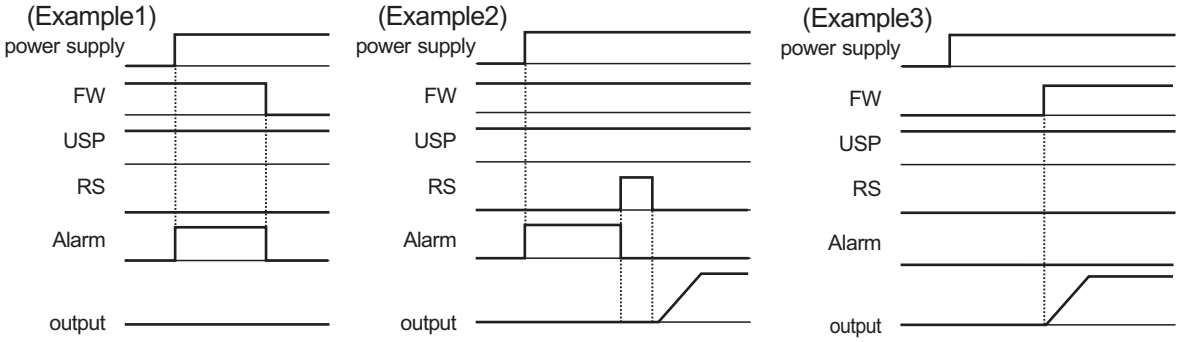
The USP function is designed as a fail safe to prevent accidental starting of the Inverter if the RUN signal is ON when the power is restored to the Inverter. When this function worked E13 is displayed. Either resetting the Inverter or turning the RUN signal OFF can clear the trip.

This function is able to disarm when the operation command is turned off. (Example 1)

If the trip is cancelled while the RUN signal is still ON then the inverter will restart automatically. (Example 2)

When the operation command is turned on after the power supply input, the inverter drives normal. (Example 3)

Assign 13(USP) to an intelligent input terminal. Unattended start protection is shown as follows:



UP/DOWN selection (UP, DWN)

Relation code
C101 : UP/DOWN memory selection
C001-C008 : Intelligent input terminal

The Inverter output frequency can be changed with the UP and DWN intelligent input terminals.

Assign 27 (UP) and 28(DWN) to two of the intelligent input terminals 1-8.

This function is valid only when the frequency command selection A001 is set to 01 or 02. However, when 01 (control terminal) is set, this can only be used for multi-speed operation.

This function will not operate when the external analog frequency command or the jogging operation is used.

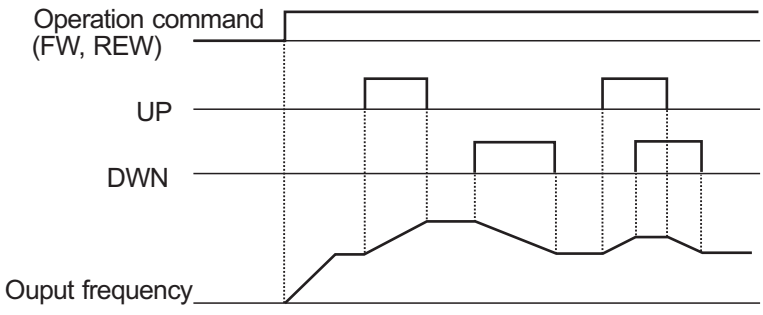
Acceleration time operates according to F002, F003/F202, F203/F302, F303 when UP/DWN terminal is ON.

To change 1st/2nd/3rd control, assign 08(SET)/17(SET3) to an input terminal, change with SET/SET3 terminal.

It is possible for the Inverter to retain the frequency setting value from the UP/DWN terminals. Parameter C101 switches the memory ON or OFF. It is also possible to clear the memory and return to the original set frequency.

Assign 29(UDC) to an intelligent input terminal and switch it on to clear the memory.

Function code	Data	Description
C101	00	This will not memorize the frequency command adjusted with UP/DWN. When power is turned ON again, set value is returned to the value before it was adjusted with UP/DWN.
	01	This memorizes the frequency command adjusted with UP/DWN. When power is turned ON again, set value is returned to the value before it was adjusted with UP/DWN.



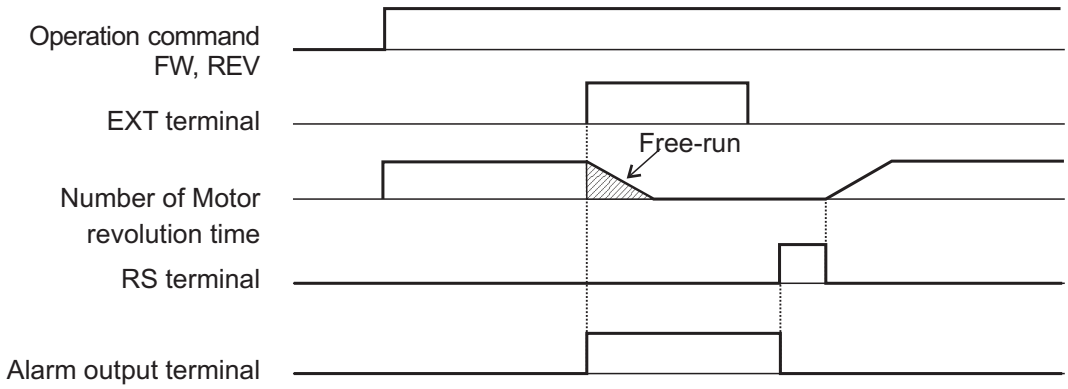
Inverter doesn't accelerate and decelerate, if UP, DWN terminal is turned ON simultaneously.

Chapter 4 Explanation of function

External trip (EXT)

Relation code
C001-C008 : Intelligent input terminal

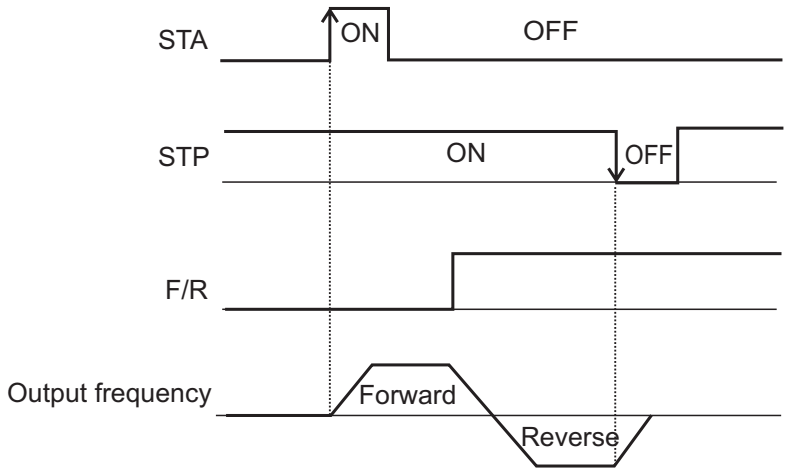
This function can be used to force the Inverter a trip situation which is Switched by an external input, i.e. PLC or relay contact.
When the EXT terminal is switched ON, the inverter trips on an E12 error and the outputis switched OFF.
Assign 12(EXT) to an intelligent input terminal.
The trip will not be canceled when the terminal is turned OFF.
To cancel the trip, the reset signal must be applied or the Inverter switched OFF and ON again at the supply.



3Wire input function(STA, STP, E/R)

Relation code
C001-C008 : Intelligent input terminal

This function is used when a momentary push start/stop control is required.
Set the operation command selection A002 to control terminal (01).
Assign 20 (STA), 21 (STP) and 22 (F/R) to three of the intelligent input terminals, and the operation becomes possible as follows. When the terminal is assigned STP terminal, FW terminal and also RV terminal become invalid. If all three input are not assigned this function will not operate.
The FW terminal and RV terminal become redundant when the 3 wire control terminal is as follows:



Chapter 4 Explanation of function

Control gain switch function(CAS)

Relation code

A044/A244/A344 : Control method
C001 - C008 : Intelligent input selection
H005/H205 : Speed response
H050/H250 : PI proportion gain
H051/H251 : PI integration gain
H052/H252 : P proportion gain
H070 : PI proportion gain for switiching
H071 : PI integration gain for switiching
H072 : P proportion gain for switiching

When sensorless vector control, 0Hz sensorless vector control, or vector control with sensor is selected in control method, this function can set and change two kids of gain, time constant in speed control system. (proportion, integration compensation)
When control gain switching is selected in intelligent input selection, gain which is set to H50, H250, H51, H251, H52, H71, H72 is selected if signal ON.
When control gain switching is not selected intelligent input selection, same gain is selected as gain in case of signal OFF.

Set item	Function code	Setting range	contents
Control method selection	A044/A244/A344	03 04 05	SLV (A344 is not) 0 Hz domain SLV (A344 is not) V2 (A244 and A344 is not)
Intelligent input selection	C001 - C008	26	CAS : control gain switching
Speed response	H005/H205	0.001 - 65.53	Unit : no dimension
PI proprotion gain	H050/H250	0.0 - 999.9/1000.	Unit :%
PI integration gain	H051/H251	0.0 - 999.9/1000.	Unit :%
P proportion gain	H052/H252	0.0 - 999.9/10.00.	Unit : no dimension
PI proprotion gain for switiching	H070	0.0 - 999.9/1000.	Unit :%
PI integration gain for switiching	H071	0.0 - 999.9/1000.	Unit :%
P proportion gain for switiching	H072	0.0 - 10.00	Unit : no dimension

P/PI Switching function(PPI)

Relation code

A044/A244/A344 : Control method
C001 - C008 : Intelligent input selection
H005/H205 : Speed response
H050/H250 : PI proportion gain
H051/H251 : PI integration gain
H052/H252 : P proportion gain
H070 : PI proportion gain for switiching
H071 : PI integration gain for switiching
H072 : P proportion gain for switiching

When sensorless vector control, 0 Hz domain sensorless vector, or control vector with sensor is selected in control method, this function can change and use control (compensation) method of speed control system to proportion integration compensation and proportion compensation.
When P/PI switching is selected in intelligent input selection, proportion integration compensation is selected if signal is OFF, and proportion compensation is selected if signal is ON.
When P/PI switching is not selected in intelligent input selection, proportion integration compensation is available.

Set item	Function code	Setting range	contents
Control method selection	A044/A244/A344	03 04 05	SLV (A344 is not) 0 Hz domain SLV (A344 is not) V2 (A244 and A344 is not)
Intelligent input selection	C001 - C008	43	PPI : P/PI switching
Speed response	H005/H205	0.001 - 65.53	Unit : no dimension
PI proprotion gain	H050/H250	0.0 - 999.9/1000.	Unit :%
PI integration gain	H051/H251	0.0 - 999.9/1000.	Unit :%
P proportion gain	H052/H252	0.0 - 999.9/10.00.	Unit : no dimension
PI proportion gain for switiching	H070	0.0 - 999.9/1000.	Unit :%
PI integration gain for switiching	H071	0.0 - 999.9/1000.	Unit :%
P proportion gain for switiching	H072	0.0 - 10.00	Unit : no dimension

Speed control mode is normally controlled by proportional-integration compensation (pi), which keeps the deviation between the actual speed and speed command becomes 0. Further, you can also achieve a porpotional control function, which can be used as drooping operation(i.e. one load with several inverters) with this option card. Se P/PI switching function to one of the intelligent input terminal 1-8 by the operator to achieve this function. (Input '43' in one of C001～C008.) When this is turned on, control mode becomes proportion control (P).

Chapter 4 Explanation of function

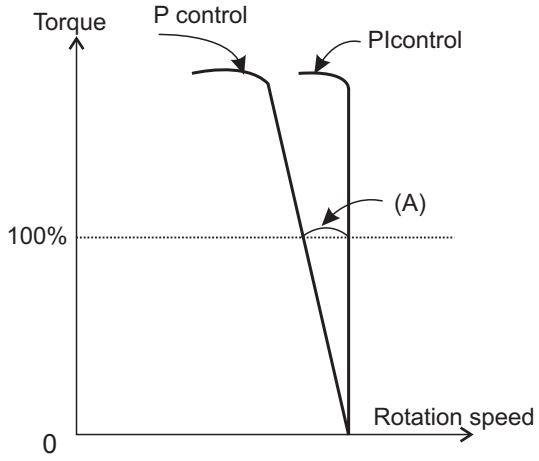
Please set proportional gain(Kpp : a value used to decide the speed change rate) to H052 by a digital operator. The relationship between the Kpp value and the speed change rate is shown below.

$$(\text{speed Change Rate}) = \frac{10}{(\text{Kpp Set Value})} \ (\%)$$

Relationship between Kpp Value and Speed Change Rate

$$(\text{speed Change Rate}) = \frac{\text{Speed Error at Rated Torque}}{\text{Synchronous speed base frequency}}$$

Relationship between Speed Change Rate and Rated Rotation Speed.



Intelligent output terminal setting

Any of the following functions can be assigned to the intelligent output terminals (11-15) or the alarm relay.
Bothe intelligent output terminals 11 - 15 and the alarm relay are all relay outputs.
All three output relays can be selected to be either NO or NC (a or b).

Relation code

C021-C025 : Intelligent output terminal
C026 : Alarm relay output terminal setting

Data	Description	Reference item	Page
00	Run : Signal during run	Signal during run	4-59
01	FA1 : Constant speed arrival signal	Frequency arrival signal	4-59
02	FA2 : Over setting frequency		
03	OL : Overload advance notice signal	Overload limit	4-41
04	OD : output deviation for PID control	PID function	4-33
05	AL : Alarm signal	Protection function	
06	FA3 :Arrival signal for only setting frequency	Frequency arrival signal	4-59
07	OTQ : Over Torque	Over torque	4-62
08	IP : Instantaneous stop signal	Instantaneous stop/under-voltage	4-37
09	UV : Under voltage signal		
10	TRQ : Torque limit	Torque limit function	4-80
11	RNT : RUN time over	RUN time over	4-61
12	ONT : ON time over	Power ON time over	4-61
13	THM : Thermal caution	Electric thermal function	4-40
19	BRK : Brake opening	Brake control function	4-69
20	BER : Brake error		
21	ZE : Zero speed detect signal	Zero speed detect signal	(Note 1)
22	DSE : Speed deviation excessive	Option function	(Note 1)
23	POK : Positioning complection	Option function	(Note 1)
24	FA4 : Arrival signal for over setting frequency 2	Frequency arrival signal	4-59
25	FA5 : Arrival signal for over setting frequency 2		
26	OL2 : Overload advance notice signal 2	Overload limit	4-41

(Note 10 Refer to the option instruction manual (N-FB).

Chapter 4 Explanation of function

Intellignet output terminal a/b (NO/NC) selection

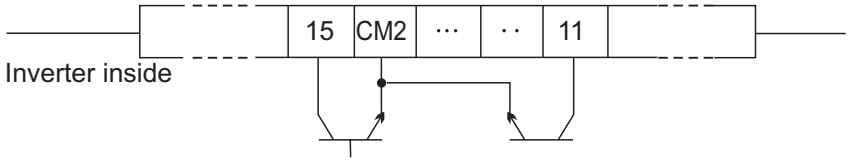
Relation code
C031-C035 : Intelligent output 11-15 a/b (NO/NC) selection
C036 : Alarm relay output a/b (NO/NC) selection

This sets the intslligent output terminal 11-15 and alarm relay output terminal contact condition to either NO or NC, (a or b). Each output is changeable individually.
Both intelligent output terminals 11-15 and the alarm relay are all relay outputs.

Set item	Function code	Data	Description
Intelligent out 11-15 a/b(NO/NC)selection	C031 - C035	00	a contact (NO)
		01	b contact (NC)
Alarm relay output a/b(NO/NC)selection	C036	00	a contact (NO)
		01	b contact (NC)

a contact : Close with [ON], open with [oFF].
b contact : Open with [ON], close with [OFF].

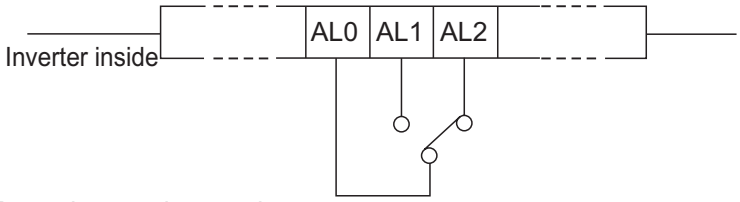
(1) Specification of the intelligent output terminals 11 - 15
Specification of the intelligent output terminals 11 - 15 is as follows.



C031-C035 Set value	Power supply	Output description	State of output terminal 11-15 terminal
00 (a contact)	On	ON	Close
		OFF	Open
	Off	-	Open
01 (a contact)	On	ON	Open
		OFF	Close
	Off	-	Open

Electric characteristic
Between each terminal and CM2 Under 4V (Voltage depression while signal is turned on) Permission Max. Voltage DC27V Permission Max. Current 50mA

(2) Specification of the alarm relay output terminal
The specifications of the alarm relay output terminal is changeover contact. Action is as follows.



Example on using as alarm

C036 Set value	Power supply	Inverter state	State of output AL1-AL0	State of output AL2-AL0
00 (a contact)	On	On abnormal	Close	Open
		On normal	Open	Close
	Off	-	Open	Close
01 (b contact)	On	On abnormal	Open	Close
		On normal	Close	Open
	Off	-	Open	Close

Contact Specification		Resistor load	Inductor load
AL1-AL0	Maximum	AC250V, 2A DC30V, 8A	AC250V, 0.2A DC30V, 0.6A
	Maximum	AC 100V, 10mA DC5V, 100mA	
AL2-AL0	Maximum	AC250V, 1A DC30V, 1A	AC250V, 0.2A DC30V, 0.2A
	Maximum	AC 100V, 10mA DC5V, 100mA	

Chapter 4 Explanation of function

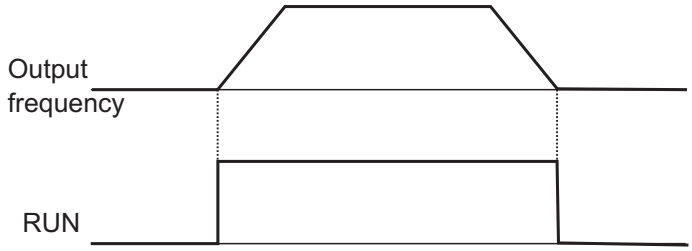
Signal during run (Run)

Relation code
C021-C025 : Intelligent output terminal

This function is to provide an output signal when the Inverter is in a running condition.

Assign 00(RUN : signal during run) to an intelligent output terminal 11 -15 or the alarm relay output terminal.

The signal is still outputted when the dc braking operates.



Frequency arrival signal (FA1, FA2, FA3, FA4, FA5)

Relation code
C021-C025 : Intelligent output terminal
C042 : Acceleration arrival frequency
C043 : Deceleration arrival frequency
C045 : Acceleration arrival frequency 2
C046 : Deceleration arrival frequency 2

When the output frequency arrives at the set frequency, an arrival signal is outputted.

Assign 01 (FA1 : constant speed arrival signal), 02 (FA2 : over setting frequency), 06 (FA3 : only setting frequecny), 24 (FA4 : over setting frequency 2), or 25 (FA5 : only setting frequency 2) to an intelligent output terminal 11-15 or the alarm relay output terminal.

Hysteresis frequency arrival signal is the following.

When ON : ON with (1% of setting frequency - maximum frequency) (Hz)

When OFF : OFF with (2% of setting frequency - maximum frequency) (Hz)

However in ti set 06(FA3), 25(FA5) case when inverter accelerate.

When ON : ON with (1% of setting frequency - maximum frequency) (Hz)

When OFF : OFF with (2% of setting frequency - maximum frequency) (Hz)

When inverter decelerates

When ON : ON with (1% of setting frequency - maximum frequency) (Hz)

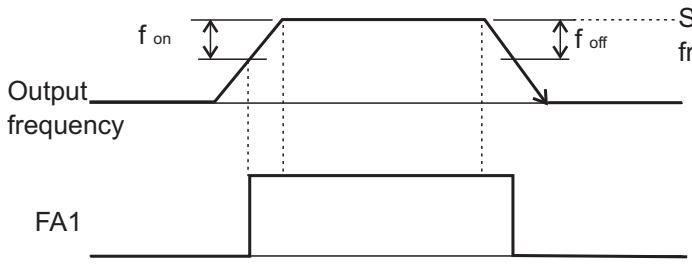
When OFF : OFF with (2% of setting frequency - maximum frequency) (Hz)

Set item	Function code	Data (Hz)	Description
Acceleration arrival frequency2	C042/C045	0.0	Arrival signal at acceleration is OFF
		0.01-400.0	Arrival signal at acceleration is ON
Deceleration arrival frequency2	C043/C046	0.0	Arrival signal at acceleration is OFF
		0.01-400.0	Arrival signal at acceleration is ON

Chapter 4 Explanation of function

(1) Output on constant speed arrival (01 : FA1)

When the inverter arrives at the set frequency with frequency setting (F001, A220, A320) or multi-speed (A021-A035), the output relay is switched.

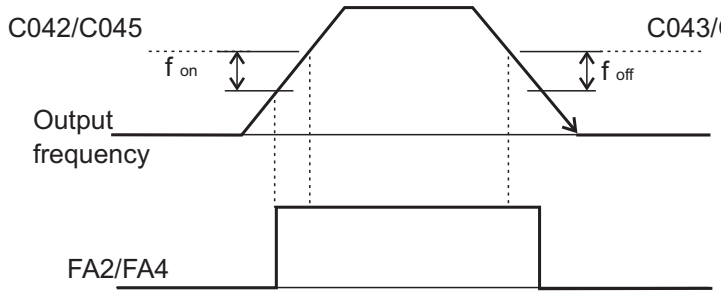


Setting frequency { F_{on} : 1% of maximum frequency, F_{off} : 2% of maximum frequency

(Example) max. frequency f max=120(Hz)
setting frequency f set = 60(Hz)
f_{on} =120 x 0.01 = 1.2(Hz)
f_{off} =120 x 0.01 = 2.4(Hz)
On acceleration : ON with 60 - 1.2 = 58.8(Hz)
On deceleration : OFF with 60 - 2.4 =57.6(Hz)

(2) Output over setting frequency (02:FA2, 24:FA4)

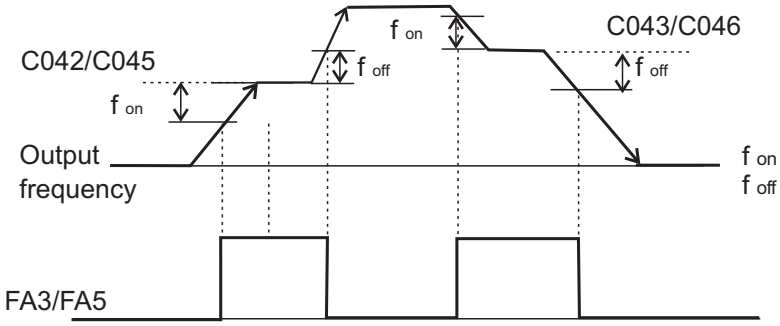
When the output is over the arrival frequency set in [C042, C043(FA2)], [C045, C046(FA4)] on adjustable speed time, the output relay is switched.



f_{on} : 1% of max. frequency
f_{off} : 2% of max. frequency

(3) Output setting frequency (06:FA3, 25:FA5)

The signal is switched only when the output frequency matches the arrival frequency set in [C042, C043 (FA3)], [C045, C046 (FA5)] on adjustable speed time.



f_{on} : 1% of max. frequency
f_{off} : 2% of max. frequency

Chapter 4 Explanation of function

RUN time / power ON time over (RNT/ONT)

When the accumulated operation time reaches or is over the setting time in b034, RUN time/power ON time over (TNT/ONT) output is switched

Relation code

b034 : Warning time level
C021-C025 : Intelligent output terminal
C026 : Alarm relay output terminal
d016 : Accumulation time monitor during RUN
d017 : Power ON time monitor

Function code	Data	Description
b034	0. 1.-9999. 10000-6553	Don't operate. Set by 10-hour unit. Set by 100 hours unit.(1000000-655300 hours)

(1) Run time over (RNT)

Assign 11(RNT) to an intelligent output terminal 11 - 15 (C021-C025) or the alarm relay output terminal (C026).

Set ON time level with b034

(2) Power ON time over (ONT)

.Assign 12(ONT) to an intelligent output terminal 11 - 15 (C021-C025) or the alarm relay output terminal (C026).

Set ON time level with b034.

Zero speed signal (ZS)

This function detects that the output of the rotation speed of a motor or the output of LAD fell off from the zero speed detection level and be the function that outputs it.

By selecting zero speed signal in an intelligent output selection this function comes into effect.

Relation code

A044/A244/A344:1st/2nd/3rd control method selection
C021-C025 : Intelligent output terminal
C063 : Zero speed detect level

This function acts to the LAD output when the control method is VC, VP, free V/f, sensor-less vectoy control or zero speed area sensor-less vector control. Also, This function acts to the output of the rotation frequency of a motor when control method is vectrol with sensor.

Set item	Function cord	Setting value	Contents
Intelligent output selection	C021-C025	21	ZS: Zero speed signal
Zero speed detection level	C063	0.00-100.0	Unit:Hz

Chapter 4 Explanation of function

Over torque (OTQ)

Relation code

A044/A244 : 1st/2nd control method selection
C021-C025 : Intelligent output terminal
C055 : Over torque level (forward driving)
C056 : Over torque level (reverse regenerating)
C057 : Over torque level (reverse driving)
C058 : Over torque level (forward regenerating)

This function can detect that estimated value of output torque of motor increase more than optional level and outputs.
When over torque signal is selected in intelligent output selection, this function is valid.
This function is valid just when sensorless vector control, 0Hz domain sensorless vector control, or vector control with sensor is selected. Make sure that output is unstable except these controls.

Set item	Function code	Setting range	Contents
Intelligent output selection	C021-C025	07	OTQ:Over torque signal
Over torque level (reverse driving)	C055	0.-200.	Unit : %
Over torque level (forward regenerating)	C056	0.-200.	Unit : %
Over torque level (reverse driving)	C057	0.-200.	Unit : %
Over torque level (forward regenerating)	C058	0.-200.	Unit : %

Alarm code output (AC0-AC3)

Relation code

C021-C025 : Intelligent output terminal
C062 : Alarm code selection

This is the function that inverter outputs trip factor as signal.
When 01(3bit) or 02(4bit) is selected in alarm code selection, intelligent output terminal, 11-13 or 11-14 compulsorily is outputted in alarm code.
Alarm code output is the following below.

				In 4bit code selection		In 3bit code selection	
14	13	12	11	Factor code	Contents of trip	Factor code	Contents of trip
AC3	AC2	AC1	AC0				
0	0	0	0	Normal	Normal	Normal	Normal
0	0	0	1	E01-E04	Over current protection	E01-E04	Over current protection
0	0	1	0	E05	Overload protection	E05	Overload protection
0	0	1	1	E07, E15	Over voltage Power source over voltage protection	E07, E15	Over voltage Power source over voltage protection
0	1	0	0	E09	Lack voltage protection	E09	Lack voltage protection
0	1	0	1	E16	Instantancous power failure protection	E16	Instantancous power failure protection
0	1	1	0	E30	IGBT error	E30	IGBT error
0	1	1	1	E06	Braking resister overload protection	-	-
1	0	0	1	E08, E11, E23	EEPROM error, CPU error, GA error	-	-
1	0	0	0	E10	CT error		
1	0	1	1	E12, E13 E35, E36	External trip, USP err, thermistor error, brake abnormal	-	-
1	0	1	0	E14	Ground fault protection	-	-
1	1	0	1	-	-	-	-
1	1	0	0	E21	Power module temperature	-	-
1	1	1	1	E24	Phase failure protection	-	-
1	1	1	0	E50-E79	RS485, option 1,2 error 0-9	-	-

Set item	Function code	Setting range	Contents
Alarm code selection	C062	00 01 02	Invalid 3bit code 4bit code

Chapter 4 Explanation of function

FM terminal

Relation code
C027 : FM selection
b081 : FM adjustment

The FM control terminal can monitor the output frequency and output current.
FM terminal is a PWM (Pulse Width Modeulation) output.

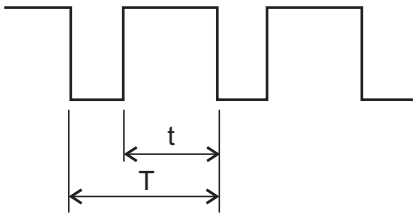
(1) FM selection

Select a signal to output from the following options.
When 03(digital frequency) is set a digital frequency counter meter is required.
Use an analog meter for all other output signals.

Function code	Data	Description	Full scale value
C027	00	Output frequency (Example 1)	0 ~ Max.frequency (Hz)
	01	Output current (Example1)	0 ~ 200%
	02	Output torque (Example 1)	0 ~ 200%
	03	Digital output (Example 2) (Net 1)	0 ~ Max.frequency (Hz)
	04	Output voltage (Example1)	0 ~ 100%
	05	Input electric power (Example1)	0 ~ 200%
	06	Thermal load ratio (Example1)	0 ~ 100%
	07	LAD frequency (Example1)	0 ~ Max.frequency (Hz)

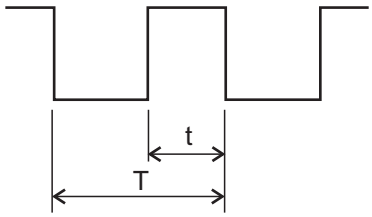
(Note 1) Display substitutes only at the time of the sensorless vector control, 0Hz domain sensorless vector control and vector control.

(Example1) Set value : 00, 01, 02, 03, 04, 05, 06, 07



Period T : constant (6.4m)
duty t/T : change

(Example2) Set value : 03



Period T : change
duty t/T : 50% fixed

(2) FM adjustment

This function is used to calibrate a meter connected to the FM terminal.

Function code	Description	Set range
b081	0.-255.	Change one by one.

(Calibration methods)

(1) Connect meter to FM-CM1.
(2) Adjust b081 so that the meter is reading the same as the output frequency on your scale.

(Example) When output frequency is 60Hz, change value of b081 so that meter is 60Hz.

Chapter 4 Explanation of function

AM terminal, AMI terminal

Relation code

b080 : AM adjustment
C028 : AM selection
C029 : AMI selection
C086 : AM offset adjustment
C087 : AMI adjustment
C088 : AMI offset adjustment

The AM terminal and the AM1 terminal can monitor the output frequency or the output current.
The AM terminal has an analog output of 0-10V.
The AM1 terminal has an analog output of 4-30mA.

(1) AM, AM1 selection

Select a signal to output from the following options:

Set item	Function code	Data	Description	Full scale value
AM selection/ AMI selection	C028/C029	00	Output frequency	0 ~ Max.frequency(Hz)
		01	Output current	0 ~ 200%
		02	Output torque	0 ~ 200%
		04	Output voltage	0 ~ 100%
		05	Input electric power	0 ~ 200%
		06	Thermal load ratio	0 ~ 100%
		07	LAD frequency	0 ~ Max.frequency(Hz)

(Note 1) Display substitutes only at the time of the sensorless vector control, 0Hz domain sensorless vector control and vector control.

(2) AM adjustment, AM1 adjustment

This function is used to calibrate a meter connected to the AM and AM1 terminal.

Set item	Function code	Data	Description
AM adjustment	b080	0.-255.	After offset adjustment with C086, adjust according to memory.
AM offset Adjustment	C086	0.0-10.0	Units : V
AMI adjustment	C087	0.-255.	After offset adjustment with C088, adjust according to memory.
AMI offset Adjustment	C088	0.0-10.0	Units : V

External thermistor(TH)

Relation code

b098 : Thermistor selection
b099 : Thermistor error level
C085 : Thermistor adjustment

Temperature protection of the external machine is possible by the use of a Thermistor fitted to you motor.
Wire the thermistor between control terminals TH and CM1.
Set the following function according to the thermistor specification.

Set item	Function code	Set value	Contents
Thermistor selection	b098	00	Invalid (No temperature protection by external thermistor)
		01	Valid notmal temperature/factor resistance element (For PTC)
		02	Valid (For NTC)
Thermistor error level	b099	0 ~ 9999.	Units :OHM Set the resistance value of temperature for trip according to thermistor methods.
Thermistor adjustment	C085	0.0 ~ 1000.	Use this as gain adjustment

Chapter 4 Explanation of function

Initialization setting

Relation code

b084 : Initialization selection
b085 : Initial data selection

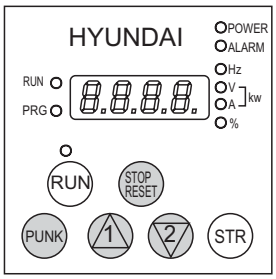
It is possible at any time to reinitialize the inverter parameters back to their factory default. The trip history can also be cleared at any time, however, if problems occur it will be difficult to fault find without the trip history for reference.

Initialization details are as follows.

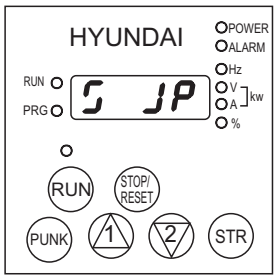
Set item	Function mode	Data	Description
Initialization selectiom	b084	00	This clears only trip history
		01	This only initalizes setting value. Setting value becomes the state on factory forwarding
		02	This clears trip history and initializes setting.
Initial data selection	b085	00	Initializing setting for Japan
		01	Initializing setting for Europe
		02	Initializing setting for America.

(Initialization methods)

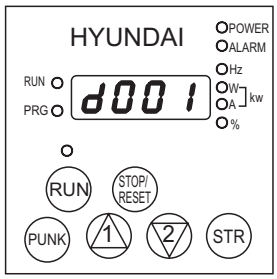
After setting the above parameters, initialize as follows :



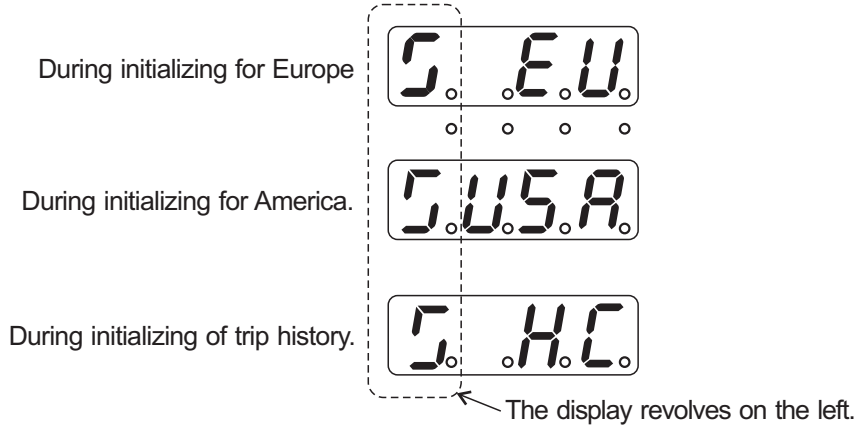
① Hold down the FUNC, UP and DOWN key and the press the stop key. When the display starts to flash and rotate release all the keys.



② During initializing Above display is for Japan. Other displays are below.



③ When "d001" is displayed in the monitor, initialization is complete.


During initializing for Europe
During initializing for America.
During initializing of trip history.
The display revolves on the left.

Chapter 4 Explanation of function

Display selection

This function can be used to limit what the digital operator can display.

Relation code
b037 : Display selection
U001-U012 : User selection

Set item	Function code	Data	Description
Display selection	b037	00	All display
		01	Function individual display (Display, no display by item set) (Example1)
		02	User setting and b037 Only item set by user selection of U001 ~U012 is displayed. (Set U001 ~ U012 first.)
User selection	U001～U012	no	NO assignment.
		d001～P032	Select the code to display. (All code is an object.)

(Example 1) When the Display selection (b037) is set to 02, only the programmed parameters are displayed.
TO set which parameters are displayed insert code groups on parameter U001-U012.
The table below shows which parameter groups can be displayed and what code is used in U001-U012.

No.	Function to restrict display	Data	Code to be restricted display		Note
1	A001	01	A005,A006,A011~A016,A101~A105, A111~A114,C081~C083,C121~C123		0,0I,02 terminal function
2	A002	01,02,03,04,05	b087		stop key function
3	A019	00	A028~A035		Multi-speed function
	C001 ~ C008	02,03,04,05			
4	A044,A244	02	b100~b113		control methods
5	A051	01	A052~A059		DC braking
6	A071	01	A072~A076,C044		PID function
7	A094	01	A095~A096		2stage adjustable frequency
8	A294	01	A295~A296		
9	b013,b213,b313	02	b015~b020		Electric thermal characteristic
10	b021	01,02	b022,b023		Overload restriction
11	b024	01,02	b025,b026		Overload restriction 2
12	b095	01,02	b090,b096		BRD function
13	C001 ~ C008	06	A038,A039		Jogging
14		08	F202,F203,A203,A204,A220, A241~A244,A261,A262,A292~A296, b212,b213,H202~H206, H220~H224,H230~H234,H250~H252,H260		2nd control
15		11	b088		free-run stop
16		17	F302,F303,A303,A304,A320, A342~A344,A392,A393,b312,b313,H306		3rd control
17		18	C102		reset
18		27,28,29	C101		UP/DWN
19	A044	00,01	A041~A243		Torque boost function
20		04	H060		OHz SLV limiter
21	A244	00,01	A241~A243		Torque boost function
22		04	H260		OHz SLV limiter
23	A044	03,04,05	b040~b046, H001 H070,H072	H002,H005,H020~H024,H030 ~H034,H050~H052,H060	Vector control
	A244	03,04		H202,H205,H220~H224,H230 ~H234,H250~H252,H260	
24	A097	01,02,03	A131		Acceleration pattern constant
25	A098	01,02,03	A132		Deceleration pattern constant
26	b098	01,02	b099,C085		Thermistor function
27	b050	01	b051~b054		Instantaneous power failure nonstop

Chapter 4 Explanation of function

No.	Function to restrict display	Data	Code to be restricted display	Note
28	b120	01	b121~b126	Brake control
29	C021~ C025,C026	02,06	C042,C043	Frequency arrival signal
30		03	C040,C041	Overload advance notice
31		07	C055~C058	over torque
32		21	C063	Zero speed detection signal
33		24,25	C045,C046	Frequency arrival signal
34		26	C111	overload advance notice 2
35	H002	00	H020~H024	Motor constant
		01,02	H030~H034	Motor constant(Auto-tuning)
36	H202	00	H220~H224	Motor constant
		01,02	H230~H234	Motor constant(Auto-tuning)
37	P010	01	P011~P023,P025~P027	option function

Stabilized factor

Relation code
H006/H206/H306 : 1st/2nd/3rd stabilized factor

When the motor is hunting or unstable, this function can be adjusted to help stabilize the motor.
When the motor is unstable, check the allowable motor selection (H003/H203) and motor pole selection (H004/H204) with your motor. If their code data is different from your motor specification, set the right data.
When R1 of usage motor is less then R1 of regular motor, raise the set value of H006/H206 gradually.
When you operate greate motor than rated capacity of inverter, lower the set value of H006/H206.
The following two functions can also assist to reduce hunting or ratting of a motor.

(1) Lower the carrier frequency (b083).
(2) Lower the output voltage gain (A045).

Set item	Function code	Data	Description
Output gain	A045	20.-100.	Units : % Lower this when hunting occurs
Carrier frequency	b083	0.5-15.0 (5.5 to 55kW)	Units : kHz Lower this when hunting occurs
		0.5-10.0 (75 to 132kW)	
Stabilized factor	H006/H206/H306	0.-255.	Raise or lower when hunting occurs.

Operation selection on option error

Relation code
P001:Option1 operation selection on error
P002:Option2 operation selection on error

When an add-in option is the cause of protective trip this function can be used to switch the trip facility off and allow the Inverter to carry on it's operation

Set item	Function code	Data	Description
Operation selection on optional error	P001/P002	00	TRP : inverter trip and output alarm when option error occurs.
		01	Run : inverter ignores this and continues operation when option error occurs.

Motor constant

Relation code
H003/H203:1st/2nd allowable motor selection
H004/H204:1st/2nd motor pole selection

Set each constant according to the motor you use.
In case of using several motors in parallel, set the constant values that are closest to the total capacity of the belonging motor.
Reduced torque or instability may occur while using auto torque boost function if these settings are incorrect.

Chapter 4 Explanation of function

Fuzzy most suitable acceleration and deceleration

Relation code

A044/A244/A344:1st/2nd/3rd control method
A085 : Running mode selection
b021/b024:Overload restriction selection 1/2
b021/b024:Overload restriction level 1/2

Fuzzy acceleration and deceleration function eliminates setting of acceleration and deceleration time in using inverter.
Inverter acceleration time should be set every time before, but this function applies the theory of fuzzy, using inverter capability at its maximum, can set acceleration and deceleration time automatically.
The acceleration time is, a time for acceleration at the current specified by the overload restriction constant when it is valid, and a time for acceleration within 150% of the requlr current when it is invalid.
The deceleration time is a time for decelerating so that the current does not exceed 150% of the specified one of the DC voltage in the inverter curcuit does not exceed 358V (770V for the 400V class).
The function sets the acceleration and deceleration time automatically in response to a change in the load or inertia in real time.

Set item	Function code	Data	Contents
Running mode selection	A085	00	Normal running
		01	Energy conservation running
		02	Fuzzy running

Precautions

(1) This function is not suitable for a machine which requires a constant acceleration and deceleration time. The acceleration and deceleration time varies with the magnitude of the load or inertia.
(2) When the inertia of machine is more than about 20 times of the motor shaft, a trip may occur.
(3) The acceleration and deceleration time of the same motor always varies with a change of the current.
(4) The fuzzy most suitable acceleration and deceleration setting function is valid only the V/F control.
(5) If the jogging running is executed when the fuzzy most suitable acceleration and deceleration setting function is selected, the normal jogging operation cannot be performed due to the fuzzy acceleration.
(6) When the load is more than the rated one, the deceleration time may be increased.
(7) When the acceleration and deceleration are repeated frequently, a trip may occur.
(8) If an internal regenerating braking circuit is used, or an external braking unit is used, the moter cannot stop within the deceleration time set with a braking resistor. In this case, do not use the fuzzy suitable acceleration and deceleration function.
(9) When using on class low motor against the inverter. Validate overload restriction function, than set the overload restriction level 1.5 times as high as rated output current of motor.

Principle

The acceleration and deceleration speed is set acceleration with the fuzzy rule from the distance to the overload restriction level and the start slopes of current and voltage.

Chapter 4 Explanation of function

Braking control function

Relation code

b120 : Braking control selection
b121 : Waiting time for releasing braking conformation
b122 : Waiting time for acceleration
b123 : Waiting time for stop
b124 : Waiting time for signal conformation
b125 : Releasing frequency
b126 : Releasing current
C001-C008 : Intelligent input terminal
C021-C025 : Intelligent output terminal

This is a function that the inverter controls external braking used in systems like elevators. By braking control function selection (b120) is set to valid(01), this function is performed as the following below.

(1) When running command turns on, the inverter begins to operate and accelerate to releasing frequency.

(2) After output frequency arrives releasing frequency, the inverter output breaking releasing signal (BRK) after waiting for the time for confirmation of releasing braking which is set in (b121).
However, if output current of the inverter is within releasing current which is set in (b121), braking releasing signal would not output the inverter would occur the trip and output braking error signal (BER).

(3) When braking confirmation signal (BOK) is set to intelligent input terminal (when 44 is set to C001 - C008), if braking releasing signal is outputted, the inverter would not accelerate just waitng time for braking confirmation which is set in (b124).
If braking confirmation signal is not inputted within waiting time for braking confirmation, the inverter would output braking error signal (BER) and would occur the trip.
If braking confirmation signal is not set to intelligent input braking terminal, the waiting confirmation would be invalid, and after the inverter would output braking releasing signal, proceed to (4).

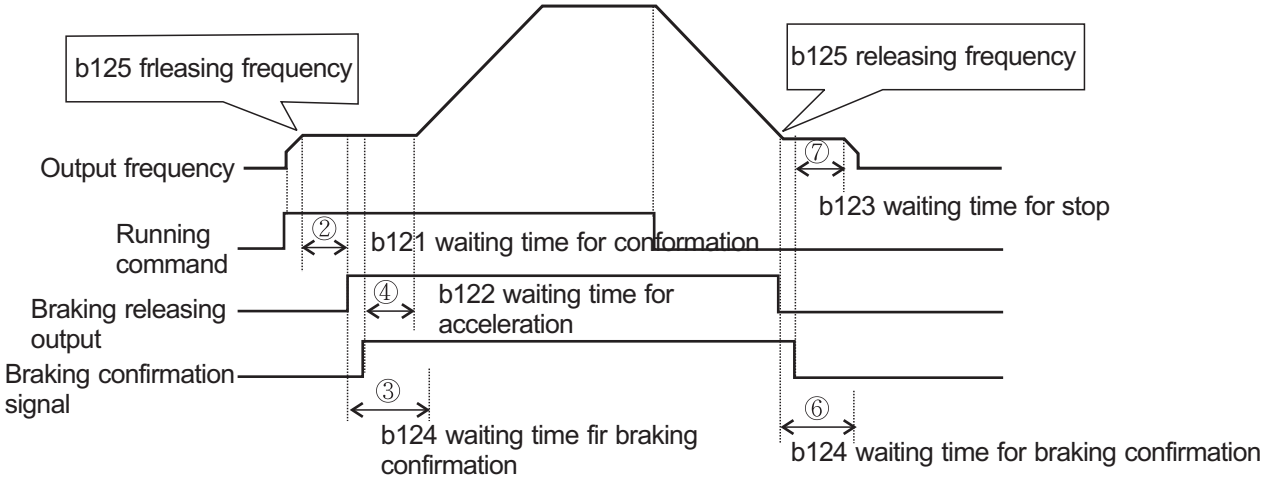
(4) After braking confirmation signal is inputted(after braking releasing signal is outputted when BOK is not selected), the inverter waits for the time for acceleration, and the begins to accelerates again and accerates to the frequency.

(5) When running command turns off, the inverter decelerates to releasing frequency and turns braking releasing signal (BRK) off.

(6) When braking confirmation signal (BOK) is set to intelligent input terminal (when 44 is set to C001-C008), after braking releasing signal turns off, the inverter would not decelerate during just the waitng time for braking confirmation which is set in (b124), and would wait for braking confirmation singal turnning off.
If braking confirmation signal does not turn off within the waiting time for braking confirmation , rhe inverter would output braking error signal (BER) and would occur the trip
If braking confirmation signal is not set to intelligent input braking terminal, the waiting time for braking confirmation would be invalid and after the inverter would output braking releasing signal, proceed to (7).

(7) After braking confirmation signal turns off (after braking releasing signal turns off), the inverter waits for the waiting time for stop, and then begins to decelerate again and decelerates to 0 Hz.

Chapter 4 Explanation of function



(Note) Timing chart that braking confirmation signal(44:BOK) is selected to intelligent input terminal.

When braking control function is used, if necessary, assign the following functions to intelligent input /output terminals. When signal outputted from external braking during releasing braking is inputted to intverter, one of intelligent output terminals (C001-C008) should be assigned braking comformation signal: BOK(44)

One of intelligent output terminals (C021-C025) should be assigned tobraking signal : BRK(19) to release braking. And when output signal at the time of braking trouble is used, signal of braking touble : BER(20) should be assigned.

When braking control function is used, sensorless vector control(A44 to 03) or 0hz domain sensorless vector control(A11 to 04) which generates high torque at starting should be recommended.

Set item

Code	Function name	Setting range
b120	Braking control function selection	00(invalid)/01(valid)
b121	The waiting time for braking releasing confirmation	0.00-5.00 s
b122	Waiting time for acceleration	0.00-5.00 s
b123	Waiting time for stop	0.00-5.00 s
b124	Waiting time for braking confirmarion	0.00-5.00 s
b125	Releasing frequency	0.00-99.99/100.0-400.0 Hz
b126	Releasing current	0% of the rated current - 200% of the rated current

b121: Set the time when output current arrives at releasing current after arriving at releasing frequency.

b122: Set the mecanical late time to release braking from releasing signal outputting

b123: Set the mecanical late time to stop braking from releasing signal off.

b124: Set the more time to input releasing stop signal which braking outputs from releasing signal.

b125: Set frequency to output braking releasing signal. Set up a bigger value than the start frequency.

b126: Set output current to permit braking releasing. Be sure that the motor would slip down easily if setting current is low

In the following case, the inverter occurs trip and outputs braking error signal(BER).(braking error:E36)

(1) In the case that output current is less than releasing curret after waiting time for braking releasing comfirmation.

(2) When braking confirmation signal is used, in the case that braking confirmation signal does not turn on within waiting time for braking confirmation druing accelerating. In the case that braking confirmation signal does not turm off within waiting time for braking confirmation or braking confirmation signal turns off although braking releasing signal is outputted, during decelerating

Chapter 4 Explanation of function

Stopping deceleration at power OFF

Relation code

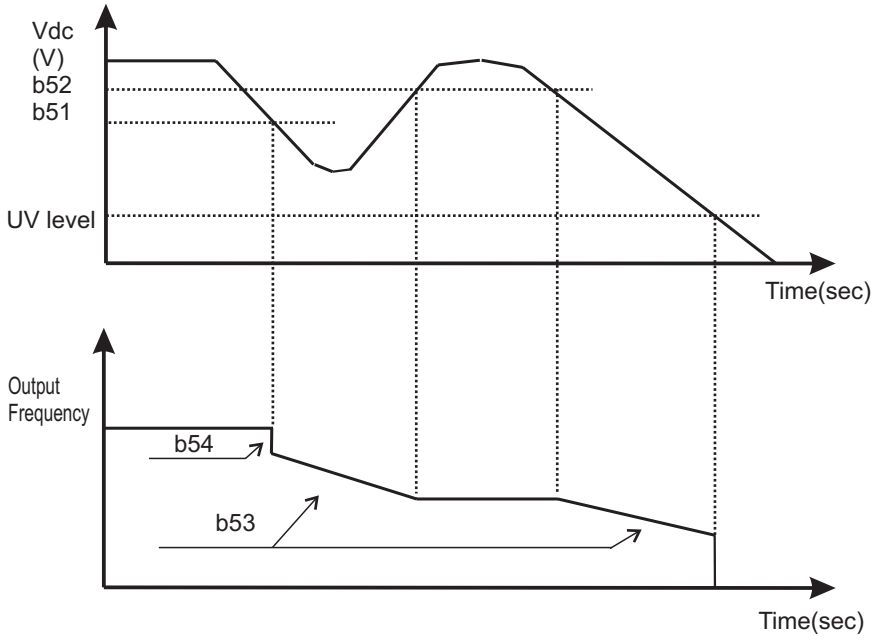
b050 : Selection of non-stop function at instantaneous power failure
b051 : Starting voltage of non-stop function at instantaneous power failure
b052 : Non-stop OV-LADSTOP level at instantaneous power failure
b053 : Non-stop deceleration time at instantaneous power failure
b054 : Starting deceleration width at instantaneous failure

This is a function that decelerates and stops not to exceed over voltage level (OV-LADSTOP : b052) after power turns off during running. Remove the electric wire of the J51 connector connected with the R0-T0 terminal when using this function. Next, connect an electric wire with the terminal R0 to the terminal P, and the terminal T0 to the terminal N. Give me an electric wire to use as more than 0.75mm^2. When selection of non-stop function at instanteneaous power failure is valid (b050), if power stop during running and at voltage less than starting voltage of non-stop function at instantaneous power of failure, at first the inverter would decelerate at width of starting deceleration at non-stop instantaneous power failure (b054) in width of frequency, and then it would decelerate at non-stop deceleration time at instantaneous power failure (b053). If it becomes over voltage due to genererating during deceleration (more than non-stop OV-LADSTOP level at instantaneous power failure : b052), the condition would be in LAD stop until over voltage is released.

Set item	Function code	Setting range, contents
Non-stop selection at instantaneous power failure	b050	00 : Non-stop function at instantaneous power failure invalid 01 : Non-stop function at instantaneous power failure valid
Starting voltage of non-stop function at instantaneous power failure	b051	0.0 - 1000.(V)
Non-stop instantaneous power failure LADSTOP level (Note1)	b052	0.0 - 1000.(V)
Non-stop deceleration time at instantaneous power failure	b053	0.01 - 99.99/ 100.0 - 999.9/ 1000.0 - 3600. (sec)
Starting deceleration width att instantaneous power failure	b054	0.00 - 10.00.(Hz)

(Note 1) When non-stop OV-LADSTOP level at instantaneous power failure (b052) is less the starting voltage of non-stop function at instantaneous power failure (b051), be sure to raise non-stop OV-LADSTOP level at instantaneous power failure (b052) to starting voltage of non-stop function at instantaneous power failure (b052) and to perform. (However, be sure not to change setting range)

(Note 2) This function is not canceled until it completes. When driving after power supply again during execution this function, terned on run key again after stopping inverter.



Chapter 4 Explanation of function

Offline autotuning function

Relation code

H001:Autotuning selection
H002:1st motor constant
H003:1st motor capacity selection
H004:1st motor pole selection
H030:1st autotuning motor constant R1
H031:1st autotuning motor constant R2
H032:1st autotuning motor constant L
H033:1st autotuning motor constant L_0
H034:1st autotuning motor constant J
A003:1st base frequency
A051:DC braking selection
A082:Motor voltage selection

This is a function for measuring and automatically setting the motor circuit constant necessary for the sensorless vector and 0Hz domain sensorless vector control.

When the sensorless vector and the 0Hz domain sensorless vector control is performed by using the motor whose circuit constant is unknown, please measure the motor circuit constant by the offline autotuning function.

When 00(Hyundai general purpose motor) in motor constant selection (H002) is set, Hyundai general purpose motor is given a constant which is initial value. In most case, the characteristics will be obtained without trouble, even if offline autotuning is not executed. (When online autotuning function mentioned) later is performed, please be sure to operate offline autotuning)

This function acts only the 1st control. Do not operate it in the 2nd/3rd control.

Set item	Function code	Setting range	Contents
Autotuning selection	H001	00 01 02	Invalid Valid(the motor does not rotate) Valid (the motor rotates)
1st motor constant selection	H002	00 01 02	Hyundai general purpose motor constant Autotuning constant Autotuning constant (Online autotuning valid)
1st motor capacity selection	H003	0.2-7.5.0/0.2-160	Unit : kW 5.5 to 55kW / 75 to 132kW
1st motor pole selection	H004	2/4/6/8	Unit : pole
1st motor constant R1	H030	—	Unit : ohm
1st motor constant R2	H031	—	Unit : ohm
1st motor constant L	H032	—	Unit : mH
1st motor constant I0	H033	—	Unit : A
1st motor constant J	H034	—	Unit : kgm2
1st base frequency	A003	30-1st Maximum frequency	Unit : Hz
DC braking selection	A051	00 01	Invalid Valid
Motor voltage selection	A081	200/215/220/230/ 240/380/400/415/ 440/460/480	When inverter is 200V class, it is possible to select When inverter is 400V class, it is possible to select

Chapter 4 Explanation of function

Precautions

(1) Fit motor base frequency (A003) and motor voltage selection (A082) to the specification of the motor measued.

(2) Motor capacity ti be measured is one frame or less maximum applicable motors. If not with this range, correct constant is not measured.

(3) By this function, the motor capacity to be measured is between the maximam applicable frame and under. From the outside motor to be not driven.

(4) In the state that the DC braking selection (A051) is set validly (01), the accurate motor constant will not be measured. Please set DC braking selection invalidly (02). (Initial value is invalid.)

(5) In the case of selecting (02) that the motor rotates in autotuning selection(H001), be cautious the following points,

1) It causes no trouble to accelate up to 80% of the base frequency,

2) Do not execute the motor from outside.

3) Release the braking.

4) Torque is not enough during autotuning. In application like an elevator, as it is possibility to slip down. The motor should be removed from the machine of the load and excute autotuning by itself. (In this case, as nertia motor J is motor itself, add the motor shaft converting value to nertia motor.)

5) In the machine restricted the motor shaft revolution permit (elevator, ball screw, and so on), the mode (01) should be selected in which operates autotuning without rotating.

(6) In spite of selecting the mode (01) that the motor does not rotates, the motor sometimes rotates.

(7) When operating by using one class low motor. Validate overload restriction function, then set the overload restriction level 1.5 times as rated output current of motor.

Setting method

(1) Set the autotuning selection (H001) to 01 or 02.

(2) Turn the Run command On.

After turning Run command on, the motor automatically runs in the following order of (1) to (7)

(1) The first AC excitation (The motor does not rotate)
↓
(2) The second AC excitation (The motor does not rotate)
↓
(3) The first DC Excitation (The motor does not rotate)
↓
(4) V/F running (The motor is accelerated up to 80% of the base frequency.)
↓
(5) SLV running (The motor is accelerated up to x% of the base frequency)
↓
(6) The second DC Excitation (The motor does not rotate)
↓
(7) Display the result of tuning.

Chapter 4 Explanation of function

Cautions

(1) When attuning (set H001 to 01) that the motor does not rotates is selected, (4) and (5) will not be performed.

(2) Revolution of (5) is like the following.

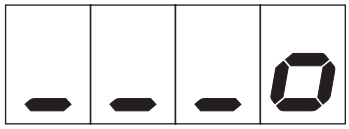
T<50s ---------- x = 40%

50s<T<100s ---------- x = 20%

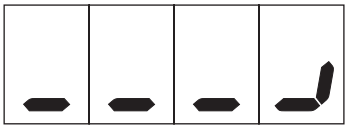
100s <= T ---------- x = 10%

(3) When autotuning operation terminates, the following is displayed.

Normal termination



Abnormal termination



When the autotuning operation terminates abnormally, please execute the autotuning again.
(When one of the keys is pressed, the display stops)

(4) When a trip occurred during the autotuning, the autotuning is forced to terminate.
(Abnormal termination is not displayed. The display of a trip has priority)

(5) If the autotuning is interrupted by power off (with the stop key or turning the run command off), the constant for autotuning may keep inside.
After making an initialization and reset the setting range, carry out autotuning again.
(In the case of normal running do in the same way)

(6) Unusual completion is indicated, and a control from finishes treatment when offline autotuning is carried out at the time of the condition of free V/F setting

Chapter 4 Explanation of function

Motor constant selection

Motor constant used sensorless vector control and 0 Hz domain sensorless vector and vector control with sensor can be selected from the following the three.

(1) Hyundai general purpose motor constant
(2) Motor constant measured in offline autotuning
(3) Optional setting motor constant

When selecting 3rd control mode, motor constant in 1st control mode appears.

Set item	Function code	Setting range	Contents
1st/2nd/3rd control method	A044/A244/ A344	00 01 02(Note 1) 03 (Note 1) 04 (Note 1) 05 (Note 1)	Constant torque characteristics Reduced torque characteristics V/F free setting Sensorless vector control 0 Hz domain sensorless vector control FB optional vector control
1st motor constant selection (Note 2)	H002	00 01 02	Hyundai general purpose motor constant Autotuning constant Autotuning constant (Online autotuning valid)
1st motor capacity selection	H003	0.2-7.5.0/0.2-160	Unit : kW 5.5 to 55kW / 75 to 132kW
1st motor pole selection	H004	2/4/6/8	Unit : pole
1st motor constant R1	H020	0.000-65.53	Unit : ohm
1st motor constant R2	H021	0.000-65.53	Unit : ohm
1st motor constant L	H022	0.00-655.3	Unit : mH
1st motor constant I0	H023	0.00-655.3	Unit : A
1st motor constant J	H024	0.001-9999.	Unit : kgm2
1st autotuning motor constant R1	H030	0.000-65.53	Unit : ohm
1st autotuning motor constant R2	H031	0.000-65.53	Unit : ohm
1st autotuning motor constant L	H032	0.00-655.3	Unit : mH
1st autotuning motor constant I0	H033	0.00-655.3	Unit : A
1st autotuning motor constant J	H034	0.001-9999	Unit : kgm2

(Note 1) In 1st control method, it is possible to select setting range 00-05.
In 1st control method, it is possible to select setting range 00-04.
In 1st control method, it is possible to select setting range 00-01.

(Note 2) The second motor constant selection uses it with 00 (Hyundai standard motor constant).

Optional setting of motor constant

When motor constant is set optionally, function code is as the following below.

1st control is valid and motor constant is 00 → Input H020 - H024 directly.
1st control is valid and motor constant is 01/02 → Input H030 - H034 directly.
1rd control is valid and motor constant is 00 → Input H020 - H224 directly.

When offline autotuning is not executed, in H030/H230 - H034/H234, the same frame constant as the constant (Hyundai general purpose motor constant) is set.

Chapter 4 Explanation of function

Online autotuning function

Online auto tuning revise the motor constant by increase of temperature, and stabilize running.

This function acts only the 1st control. Do not operate it in the 2nd/3rd control.

Set item	Function code	Setting range	Contents
Motor constant selection	H002/H202	00 01 02	Hyundai general purpose motor data Autotuning data Autotuning data (Online autotuning data valid)

Precautions

(1) Be sure to execute offline autotuning before executing online autotuning.

(2) Be sure to execute autotuning once when Hyundai general purpose motor, as the data for online autotuning is computed during offline autotuning.

(3) After the motor stops, online autotuning runs for maximum 5s. (DC Excitation is carried out 1 time for tuning of R1 and R2. Furthermore, this result is not reflected to the display.) If the run command is input during this time, it is given priority to online autotuning. Online autotuning terminates halfway. (The tuning result is not reflected)

(4) If DC braking is set when the motor stops, online autotuning is executed after DC braking operation terminates.

Setting method

(1) Set the motor constant selection (H002/H202) to the data of autotuning that is valid online tuning. (Give the auto tuning selection (H001) as the ineffectiveness (00).)

(2) Input the run command. Online auto tuning is carried out automatically at the time of the stoppage.

Chapter 4 Explanation of function

Sensorless vector control

This function is the method that the revolution of motor and output] torque are estimated by output current, voltage of the inverter and motor constant of setting. It is possible to operate high starting torque and high accuracy at law frequency (0.5Hz).

In the case of using this function, please set surely the suitable motor constant of using the motor according to the parameter of "selection of motor constant"

Relation code

A001 : Frequency commanding method
A044, A244 : Control method
F001 : Output frequency setting
b040 : Selection of torque limit
b041-b044 : Torque limit of 4zone
H002, H202 : Selection first, second motor constant
H003, H203 : Selection of first, second motor capacity
H004, H204 : Selection of first, second motor pole
H005, H205 : 1st/2nd speed response
H020, H220 : 1st/2nd motor constant R1
H021, H221 : 1st/2nd motor constant R2
H022, H222 : 1st/2nd motor constant L
H023, H223 : 1st/2nd motor constant I0
H024, H224 : 1st/2nd motor constant J
H050, H250 : 1st/2nd PI proportion gain
H051, H251 : 1st/2nd PI integration gain
H052, H252 : 1st/2nd P proportion gain

Caution

(1) If the inverter operates less than twice capacity for the maximum adopted motor, the full performances may not be demonstrated.
(2) If satisfactory performance can not be obtained, please adjust the motor constant for the phenomena according to following table.
(3) Please use carrier frequency in more than 2.1kHz absolutely. Inverter can't operate normally in less than 2.1kHz.

Status of running	Phenomena	Contents of adjustment	Adjusting parameter
Driving	Speed fluctuation is Minus	Set"Motor constant R2"bigger and bigger slowly until 1.2 times for preset constant.	H021/H221
	Speed fluctuation is plus	Set"Motor constant R2" smaller and smaller slowly until 0.8 times for preset constant.	H021/H221
Regenerating	Lack of torque at low frequency	Set"Motor constant R1"bigger and bigger slowly until 1.2 times for preset constant.	H020/H220
		Set"Motor constant I0"bigger and bigger slowly until 1.2 times for preset constant.	H023/H223
At starting	The shock is occurred at starting	Set"Motor constant J"bigger and bigger slowly until 1.2 times for preset constant.	H024/H224
At deceleration	Unstable of motor rotation	Set speed response smaller	H005/H205
		Set"Motor constant J"smaller for preset constant.	H024/H224
During torque limit	Insufficient torque during torque limit at low speed	Set overload restriction level lower than torque limit level.	b021 b041-b044
At low frequency operation	Irregular of rotation	Set"Motor constant J"bigger for preset constant.	H024/H224

(Note) 1 Use carrier frequency over 2.1kHz certainly. It doesn't operate correctly under 2.1kHz.
2 When using one class low motor against the inverter, Torque limit setting value (b041-b044) is from following formula and T value is calculated by following formula. Don't set T over 200% otherwise it will cause of failure.
Formula A: T=Torque limit setting value x (inverter capacity) / (Motor capacity)
(Example) Inverter 0.75kW, At motor 0.4kW, Torque limit setting that is for T = 200% become from formula A
Torque limit setting value (b041-b044) = T x (Motor capacity) / (Inverter capacity)
= 200% x (0.4kW) / (0.75kW) = 106%

Chapter 4 Explanation of function

0Hz Domain sensorless vector control

When this function is performed, raised torque running is possible 0Hz range (0-2.5Hz command) by Hyundai original torque control.
When this function is performed, set A004 in 04.
When this function is performed, set the motor most applicable setting, properly according to the another item motor constant selection.

Relation code

A001 : Frequency command selection
A044, A244 : Control method
F001 : Frequency command setting
b040 : Torque limit selection
b041-b044 : 4zone torque limit
H002, H202 : 1st/2nd motor constant selection
H003, H203 : 1st/2nd motor capacity selection
H004, H204 : 1st/2nd motor pole selection
H005, H205 : 1st/2nd speed response
H020, H220 : 1st/2nd motor R1
H021, H221 : 1st/2nd motor R2
H022, H222 : 1st/2nd motor L
H023, H223 : 1st/2nd motor I0
H024, H224 : 1st/2nd motor J
H050, H250 : 1st/2nd PI proportion gain
H051, H251 : 1st/2nd PI integration gain
H052, H252 : 1st/2nd P proportion gain
H060, H260 : 1st/2nd 0SLV limiter

Precautions

(1) Set the inverter one frame up of the motor.
(2) If this inverter operates less than twice capacity for the maximum adopted motor, the full performance may not demonstrated.
(3) If satisfactory characteristics can not be obtained during the 0Hz sensorless vector running, please adjust motor constant for the phenomena according to the following table.
(4) Please use carrier frequency in more than 2.1kHz absolutely. Inverter can't operate normally in less than 2.1kHz.

Status of running	Phenomena	Contents of adjustment	Adjusting parameter
Driving	Speed fluctuation is Minus	Set"Motor constant R2"bigger and bigger slowly until 1.2 times for preset constant.	H021/H221
	Speed fluctuation is plus	Set"Motor constant R2" smaller and smaller slowly until 0.8 times for preset constant.	H021/H221
Regenerating	Lack of torque at low frequency	Set"Motor constant R1"bigger and bigger slowly until 1.2 times for preset constant.	H020/H220
		Set"Motor constant I0"bigger and bigger slowly until 1.2 times for preset constant.	H023/H223
At starting	The shock is occurred at starting	Set"Motor constant J"bigger and bigger slowly until 1.2 times for preset constant.	H024/H224
At deceleration	Unstable of motor rotation	Set speed response smaller	H005/H205
		Set"Motor constant J"smaller for preset constant.	H024/H224
At low frequency operation	Irregular of rotation	Set"Motor constant J"bigger for preset constant.	H024/H224

(Note) 1 Use carrier frequency over 2.1kHz certainly. It doesn't operate correctly under 2.1kHz.
2 Torque limit setting value (b041 - b044) is from following formula and T is calculated by following formula. Don't set T over 200% otherwise it will cause of failure.
Formula A: T=Torque limit setting value x (inverter capacity) / (Motor capacity)
(Example) Inverter 0.75kW, At motor 0.4kW, Torque limit setting that is for T = 200% become from formula A
Torque limit setting value (b041-b044) = T x (Motor capacity) / (Inverter capacity)
= 200% x (0.4kW) / (0.75kW) = 106%

Chapter 4 Explanation of function

Torque monitor function

Relation code

A044/A244 : 1st/2nd control method
C027 : FM selection
C028 : AM selection
C029 : AM1 selection
H003/H203 : 1st/2nd motor capacity selection
H004/H204 : 1st/2nd motor pole selection

- This is a function for monitoring motor presumed output torque when sensorless vector control, 0Hz domain sensorless vector control, and vector control with sensor are selected in selection method.
- When monitor is carried out in digital operator, select display code d012.
- When monitor is carried out in control terminal, refer to the explanation about another section of the chapter4, FM terminal, AM terminal, or AM1 terminal.
- When control method selected VC, VP1.7 power or free V/f setting, take care that this function is invalid, and display or output signal of control terminal is unstable.
- Torque monitor value of this function displays 100% output torque when the motor rotates at synchronized revolution in the rated frequency equivalent to the rated output of the motor.
- This funcion presumes output torque prior to motor current, therefore error is about 20% when the motor which output is same as inverter is used.

Set item	Function code	Setting range	contents
Control method selection	A044/A244	(00) (01) (02) 03 04 05	VC VP 1.7 power V/f free setting)A344 is not) SLV(A344 is not) 0 Hz domain SLV (A344 is not) V2 (A2344/A244 is not)
FM selection	C027	(00) (01) 02 (03) (04) (05) (06) (07)	Output frequency Output current Output torque Digital output frequency Output voltage Input electric power Thermal load rate LAD frequency
AM selection	C028	(00) (01) 02 (04) (05) (06) (07)	Output frequency Output current Output torque Output voltage Input electric power Thermal load rate LAD frequency
AM1 selection	bC029		
Motor capacity selection	H003/H203	0.20-75.0 / 0.2-160	Unit : kW 5.5 to 55kW / 75 to 132kW
Motor pole selection	H004/H204	2/4/6/8	Unit : pole

Chapter 4 Explanation of function

Torque limit function

Relation code

A044/A244 : 1st/2nd control method
b040 : Torque limit selection
b041-b044 : Torque limit 1 - 4
C001-C008 : Intelligent input selection
C021-C025 : Intelligent output selection

This function limits motor output torque when sensorless vector control, 0Hz domain sensorless vector control, or vector control with sensor are selected.
In torque limit function method, the following three are selected in b040 torque limit selection screen.

1) 4zone individual setting mode
This mode sets torque limit in 4 zones, forward driving and regenerating, reverse driving and regenerating, to digital operator setting code b041-b044 individually.

2) Terminal changing mode
By combination of torque limit changing terminals 1and2, this mode changes and uses torque limit 1-4 set by in digital operator setting. Selected torque limit range is valid in every driving condition.

3) Analog input mode
This mode sets torque limit value by voltage given to 02 terminal of control terminal. 0-10V is equal to torque limit value 0-200%. Selected torque limit value is valid in every driving condition.

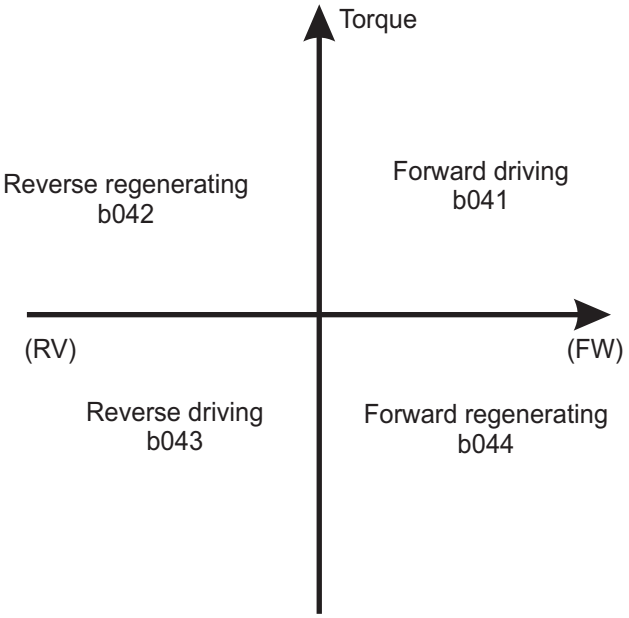
4) Option 1, Option 2
It comes into valid when using the option board(N-DG).
Refer to option instruction manual.

When torque control valid / invalid function (TL) is set to intelligent input terminal, torque limit function is valid only during the signal turning ON. During OFF, torque limit setting is invalid, torque control value is 200% of maximum.
And when torque control valid / invalid function (TL) is not set, torque limit function is always valid.
Torque limit value in this function is 200% of maximum current which inverter can output. Therefore, output torque may change in accordance with motors combined. Make sure that the absolute value of torque is not appeared. When torque control signal is selected in intelligent output selection, torque limit above-mentioned turns ON while torque limit function is performed.

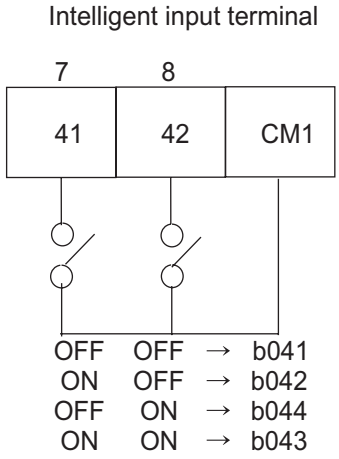
Set item	Function code	Setting range	contents
Control method selection	A044/A244	(00) (01) (02) 03 04 05	VC VP 1.7 power V/f free setting SLV 0 Hz domain V2 (A2344 is not)
Torque limit selection	b040	00 01 02 03 04	4 zone individual setting Terminal changing Analog input Option 1 Option 2
Torque limit 1	b041	0 - 200	Unit : % (forward driving in 4 zone individual setting)
Torque limit 2	b042	0 - 200	Unit : % (reverse regenerating in 4 zone individual setting)
Torque limit 3	b043	0 - 200	Unit : % (reverse driving in 4 zone individual setting)
Torque limit 4	b044	0 - 200	Unit : % (forward regenerating in 4 zone individual setting)
Intelligent input selection	C001-C008	40 41 42	Torque control valid / invalid Torque limit switching 1 Torque limit switching 2
Intelligent output selection	C021-C025	10	During torque limit

Chapter 4 Explanation of function

Torque limit when 00 (4 quadrant mode) is chosen by torque limit choice (b040) becomes the bottom figure.



When 01 (terminal switching) is chosen by torque limit choice (b04), torque limit 1 changed by torque limit switching 1,2 assigned to intelligent input terminal - 4 are set up as the bottom figure.
(Example) When torque limit switching 2 (42) was assigned to torque limit switching 1 (41), intelligent input terminal 8 in intelligent input terminal 7.



When using torque limit function at low speed level, use overload restriction together.

Chapter 4 Explanation of function

Torque LADSTOP function

This function temporarily stops frequency acceleration and deceleration function (LAD) when toque limit is performed, if sensorless vector control, 0Hz domain sensorless vector, or vector control with sensor is selected.

Relation code

A044/A244 : Control method
b040 : Torque limit selection
b041 - b044 : 4 zone torque limit
b045 : Torque LADSTOP selection

Set item	Function code	Setting range	contents
Control method selection	A004/A244	00 01 02 03 04 05	VC VP 1.7 power V/f free setting SLV 0Hz domain V2(A244 IS NOT)
Torque limit selection	b040	00 01 02 03 04	4 zone individual setting Terminal changing Analog input Option 1 Option 2
Torque limit 1	b041	0 - 200	Unit : %(forward driving in 4 zone individual setting)
Torque limit 2	b042	0 - 200	Unit : %(reverse driving in 4 zone individual setting)
Torque limit 3	b043	0 - 200	Unit : %(reverse driving in 4 zone individual setting)
Torque limit 4	b044	0 - 200	Unit : %(forward driving in 4 zone) individual setting
Torque LADSTOP selection	b045	00 01	Valid Invalid
Intelling iput selection	C001 - C008	40 41 42	Torque control valid / invalid Torque limit switching 1 Torque limit switching 2

Chapter 4 Explanation of function

Communication function

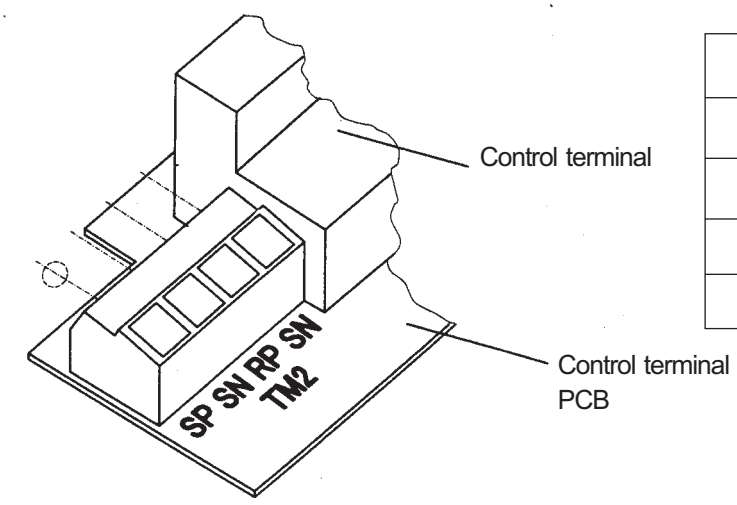
Relation code
A001 : Frequency selection
A002 : Operation command selection
C070 : Data command
C071 : Communication transmission speed
C072 : Communication code
C073 : Communication bit
C074 : Communication parity
C075 : Communication stop bit
C078 : Communication waiting time

Serial communication i possible from the Inverter to any external equipment using RS485 protocol. This function is built-in as standard and is controlled by the TM2 control terminals.

(1) Communication specification

Item	Specification	Notes
Transmission speed	2400/4800/9600/19200 bps	Selection with operator
Communication methods	Half duplex communication methods	
Synchronising methods	Direct current transmission	
Transmission code	ASCII code	
Transmission methods	Transmission from lower bit	
Communication interface	RS485	
Data bit	7/8 bit	Selection with Operator
Parity	No parity/even/odd	Selection with Operator
Stop bit	1/2bit	Selection with Operator
Start methods	One-way start form by command of host side	
Waiting time	10-1000[ms]	Setting with operator
Connect form	1:N (N = Maximum 32)	station number is selected with operator
Error check	Overrun / Fleming / BCC / Vertical / Horizontal parity.	

<RS485 port specification and connection>
Use TM2 of control terminal PCB of RS485 communication function.

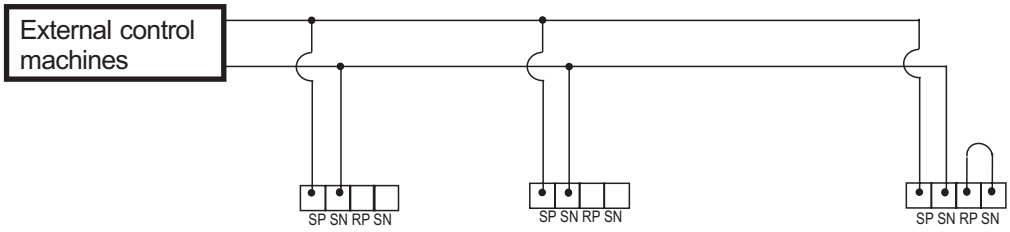


Abbreviation name	Description
SP	Transmission and Reception + side
SN	Transmission and Reception + side
RP	Transmission resistance valid terminal
SN	Transmission resistance valid terminal

Chapter 4 Explanation of function

Connect each inverter in parallel as shown below. It is necessary to short terminals RP and SN on the last inverter in the link(even if communication is to only one inverter the link should still be mabe)

By shorting between RP and SN, the terminal resistance is increased and controls the reflection of the signal.



(2) Setting

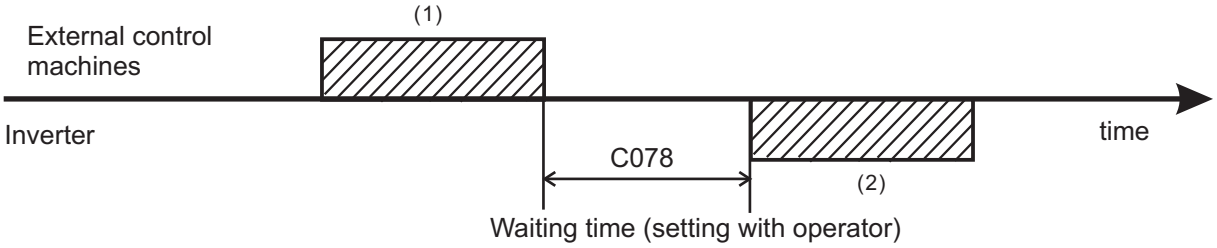
The following setting are required to operate RS485 communication

Set item	Function code	Set value	Description
Data command	C070	02	Operator
		03	RS485
		04	Option 1
		05	Option 2
Communicating transmission speed	C071	02	Loop-back test
		03	2400bps
		04	4800bps
		05	9600bps
		06	19200bps
Communication code	C072	1. ~32.	This assigns the station number of the inverter. This is used when you control more than one simultaneously.
Communication bit	C073	7	7bit
		8	8bit
Communication parity	C074	00	No parity
		01	Even parity
		02	Odd parity
Communicatio bit	C075	1	1bit
		2	2bit
Communication waiting time	C078	0. ~1000.	Units : ms Refer to it.(3)

Chapter 4 Explanation of function

(3) Communication protocol

The method the communication protocol is shown below in the time diagram.



The following is indicated.

(1) Frame transmitted from external control machines to the inverter.

(2) Frame replied from inverter to the external control machines.

Frame 92) from the inverter is a reply to frame (1) from the external control machine, the active output is not operated.

The commands are shown below:

Command list

Command	Command description	Advisability of all code	Notes
00	Forward / backward /stop command	○	
01	Setting of frequency command	○	
02	Setting of intelligent terminal state	○	
03	Collective reading of monitor data	X	
04	Reading of inverter state	X	
05	Reading of trip history	X	This doesn't operate unless b084 is set to (01 or 02). (Clear of the trip origin)
06	Reading of 1 setting item	X	
07	Setting of 1 set item	○	
08	Returning of each set value to initial value	○	
09	This checks whether set value can be conserved to EEPROM or not.	X	
0A	This conserves set value to EEPROM	○	
0B	Recalculation of internal constant.	○	

Chapter 4 Explanation of function

Explanation of each command is the following.

(i) 00 command : This controls the forward, backward and stop command. (Set yp A002 in 03 in the case that this command is used)

Transmission frame

Frame format

STX	Code	Command	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	00
Data	Transmission data	1 byte	(Note 1) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Data	Description	Note
0	Stop command	
1	Forward command	
2	Reverse command	

(Note 1)

(Example) When you transmit forward command to code 01

(STX)l01l00l1l(BCC)l(CR) ⟶ (ASCII converter) 02l03 31l30 30l31l33 30l0D

Reply frame

On normal reply : (4)-(i) Reference

On abnormal reply : (4)-(ii) Reference

(ii) 01 command : This is to set frequency command. (Set up A001 in 03 in the case that this command is used.)

Transmission frame

Frame format

STX	Code	Command	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	01
Data	Transmission data	6 byte	(Note 2) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 2) when you set code 01 for 5Hz

(STX)l01l00l1l(BCC)l(CR) ⟶ (ASCII converter) 02l03 31l30 30 30 35 30 30 l30 35l0D

(Note) The data is 100 times as big as set value.

(Example) 5(Hz) ⟶ 500 ⟶ 000500 ⟶ (ASCII converter) 30 30 30 35 30 30

Reply frame

On normal reply : (4)-(i) Reference

On abnormal reply : (4)-(ii) Reference

Chapter 4 Explanation of function

(iii) 02 command : This sets the state of the intelligent terminals.

Transmission frame

Frame format

STX	Code	Command	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	02
Data	Transmission data	16 byte	(Note 3) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note3) Data (sixteenth) of intelligent terminal and contents
(the details refer to intelligent input terminal function.)

Data (Hex)	Description	Data (Hex)	Description
0000000000000001	FW : forward command	0000000001000000	PIDC : PID integral reset
0000000000000002	RV : reverse command	0000000002000000	
0000000000000004	CF1 : multi-speed1(binary operation)	0000000004000000	CAS : control gain switch function
0000000000000008	CF2 : multi-speed2(binary operation)	0000000008000000	UP : remote operation Accelerating speed
0000000000000010	CF3 : multi-speed3(binary operation)	0000000010000000	DWN : remote operation Decelerate speed
0000000000000020	CF4 : multi-speed4(binary operation)	0000000020000000	UDC : remote operation data clear
0000000000000040	JG : jogging(inching operation)	0000000040000000	
0000000000000080	DB : external DC control	0000000080000000	OPE : Force operation ope
0000000000000100	SET : 2nd control	0000000100000000	SF1 : multi-speed1(bit run)
0000000000000200	2CH : two stage adjustable	0000000200000000	SF2 : multi-speed2(bit run)
0000000000000400	-	0000000400000000	SF3 : multi-speed3(bit run)
0000000000000800	FRS : free-run stop	0000000800000000	SF4 : multi-speed4(bit run)
0000000000001000	EXP : external trip	0000001000000000	SF5 : multi-speed5(bit run)
0000000000002000	USP : unattended start protection	0000002000000000	SF6 : multi-speed6(bit run)
0000000000004000	CS : commercial change	0000004000000000	SF7 : multi-speed7(bit run)
0000000000008000	SFT : software lock (control terminal)	0000008000000000	OLR : overload restriction setting
0000000000010000	AT : analog input voltage/current select	0000010000000000	TL : Torque limit
0000000000020000	SET3 : 3rd control	0000020000000000	TRQ1 : Torque limit 1 switch
0000000000040000	RS : reset	0000040000000000	TRQ2 : Torque limit 2 switch
0000000000080000	-	0000080000000000	PPI : P/PI control switch
0000000000100000	STA : 3wire start	0000100000000000	BOK : Brake confirmation
0000000000200000	STP : 3wire holding	0000200000000000	ORT : Orientation command
0000000000400000	F/R : 3wire forward	0000400000000000	LAC : LAD Cancel
0000000000800000	PID : PID selection (valid/invalid)	0000800000000000	PCLR : Position command
		0001000000000000	STAT : Pulse train input permission

(Example) When you make (forward), (multi-speed1) and (multi-speed2) active on inverter setting of code 01, the calculation of data is
0x0000000000000001+0x0000000000000004+0x0000000000000008=0x000000000000000D
so transmission frame is (STX) I01I02I000000000000000DI(BCC)I(CR)
Reply frame
On normal reply : Refer to (4) -(i)
On abnormal reply : Refer to (4)-(ii)

(iv) 03 command : This reads monitor data collectively.

Transmission frame

Chapter 4 Explanation of function

Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	03
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Frame format

STX	Code	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Data	Each monitor data on trip	104 byte	(Note 4) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 4) Each monitor value

Monitor item	Units	Competitive rate	Data size	Note	
Output frequency	Hz	x100	8byte	Tenth ASCII code	Upper bite----------lower bite
Output current	A	x10	8byte	Tenth ASCII code	
Revolution direction	-	-	8byte	0: stop, 1:forward, 2:backward	
PID feedback monitor	%	x100	8byte	Tenth ASCII code	
Intelligent input monitor	-	-	8byte	Note 7 reference	
Intelligent output monitor	-	-	8byte	*5) reference	
Frequency converting monitor	-	x100	8byte	*6) reference	
Output torque monitor	%	x1	8byte	Tenth ASCII code	
Output voltage monitor	V	x10	8byte	Tenth ASCII code	
Electric power monitor	kW	x10	8byte	Tenth ASCII code	
-	-	-	8byte	(00000000) padding data	
RUN time monitor	h	x1	8byte	Tenth ASCII code	
ON time monitor	h	x1	8byte	Tenth ASCII code	

(Note 5) Intelligent input terminal monitor

Item	Data
FW(Forward terminal)	00000001
1 (1st terminal)	00000002
2 (2nd terminal)	00000004
3 (3rd terminal)	00000008
4 (4th terminal)	00000010
5 (5th terminal)	00000020
6 (6th terminal)	00000040
7 (7th terminal)	00000080
8 (8th terminal)	000000100

(Note 6) Intelligent output terminal monitor

Item	Data
AL(Alarm terminal)	00000001
11 (1st terminal)	00000002
12 (2nd terminal)	00000004
13 (3rd terminal)	00000008
14 (4th terminal)	00000010
15 (5th terminal)	00000020

(v) 04 command : This reads the state of the inverter.

Chapter 4 Explanation of function

Transmission frame
Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	04
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Replay frame
Frame format

STX	Code	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Data	Each monitor data on trip	8 byte	(Note 7) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 7) The data to indicate status contents of inverter is constructed from the following three factors [A), B), C)].

Data	Status A	Status B	Status C	00(reservation)

Inver status A)

Code	Status
00	Initial status
01	Vdc on waiting settlement
02	On stopping
03	On running
04	On FRS
05	On JG
06	On DB
07	On reading frequency
08	On retrying
09	On UV
10	On TRIP
11	On waiting reset

Inver status B)

Code	Status
00	On stopping
01	On running
02	On tripping

Inver status C)

Code	Status
00	----
01	Stop
02	Deceleration speed
03	Constant speed
04	Acceleration speed
05	Forward
06	Reverse
07	Reverse from forward
08	Forward from reverse
09	Forward start
10	Reverse start

Chapter 4 Explanation of function

(vi) 05 command : This reads trip history data.

Transmission frame

Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	05
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Replay frame

Frame format

STX	Code	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Data	Each monitor data on trip	440 byte	(Note 8) reference
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 8) The monitor data (trip history) on trip memorizes the last six errors six errors sith an accumulated count number (8byte)

Accumulated count number	Trip history 1	----	Trip history 6

Monitor item	Units	Magnification	Data size	Note	
Trip factor	-	-	8byte	Cord display	Upper
Inverter status A)	-	-	8byte		
Inverter status B)	-	-	8byte	04 command	
Inverter status C)	-	-	8byte	Note 7 reference	
Output frequency	Hz	x10	8byte		
Accumulated RUN time	hour	x1	8byte	Tenth ASCII code	Lower
Output frequency	A	x10	8byte	Tenth ASCII code	
Current voltage	V	x10	8byte	Tenth ASCII code	
Accumulated RUN time	hour	x1	8byte	Tenth ASCII code	
Power source ON time	hour	x1	8byte	Tenth ASCII code	

Chapter 4 Explanation of function

(vii) 06 command : This returns 1 set item.

Transmission frame
Frame format

STX	Code	Command	Parameter	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	08
Parameter	Parameter number of data	4 byte	(Note 9)
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note9) The range of parameter to get, F002-, A001-, b001-, C001-, H003-, P001- (F001 uses 01 command).

Replay frame
Frame format
On normal reply

STX	Code	ACK	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
ACK	Control code(ACKnowledge)	1 byte	ACK (0x06)
Data	Data (tenth ASCII code)	8 byte	(Note 10)
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 10) When data is the selected item, this transmits and receives corresponding to station number.
The data of H003, H203(motor capacity capacity selection) is indicated following code data.

Code data	00	01	02	03	04	05	06	07	08	09	10
Internal, USA mode (b085=00,02)	0.2kW	-	0.4	-	0.75	-	1.5	2.2	-	3.7	-
EU mode (b085=01)	0.2kW	0.37	-	0.55	0.75	1.1	1.5	2.2	3.0	-	4.0
Code data	11	12	13	14	15	16	17	18	19	20	21
Internal, USA mode (b085=00,02)	5.5kW	7.5	11	15	18.5	22	30	37	45	55	75
EU mode (b085=01)	5.5kW	7.5	11	15	18.5	22	30	37	45	55	75

Refer to the function code list please
On abnormal reply : (4) - (ii) Reference

(viii) 07 command : This sets 1 set item.

Transmission frame
Frame format

STX	Code	Command	Parameter	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32, FF(broadcast)
Command	Transmission command	2 byte	08
Parameter	Parameter number of data	4 byte	(Note 9)
Data	Data (tenth ASCII code)	8 byte	(Note 10)
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Reply frame
On normal reply : (4) - (i) Reference
On abnormal reply : (4) - (ii) Reference

Chapter 4 Explanation of function

(ix) 08 command : This returns each set value set value initial value.
This works in conjunction with initial selection (b084). If b084 is 00, the trip history is cleared.
Transmission frame
Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	08
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Replay frame
On normal reply : (4) - (i) Reference
On abnormal reply : (4) - (ii) Reference

(x) 09 command : This check whether it is possible to store value to EEPROM or not.
Transmission frame
Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	09
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Transmission frame
Frame format

STX	Code	ACK	Data	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
ACK	Control code(ACKnowledge)	1 byte	ACK(0x06)
Data	Data	2 byte	Allowance with01
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

On normal reply : (4) - (i) Reference

Chapter 4 Explanation of function

(xi) OA command : This stores the set value to the EEPROM.

Transmission frame

Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	OA
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Replay frame

On normal reply : (4) - (ⅰ) Reference

On abnormal reply : (4) - (ⅱ) Reference

(vii) 0B command : This recalculates the internal motor constants.

This function is required when base frequency and parameter of H.... Is changed by Rs485

Transmission frame

Frame format

STX	Code	Command	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
Command	Transmission command	2 byte	OB
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

Replay frame

On normal reply : (4) - (ⅰ) Reference

On abnormal reply : (4) - (ⅱ) Reference

Chapter 4 Explanation of function

(4) Acknowledge / Negative acknowledge response

(i) Acknowledge response

Reply frame

Frame format

STX	Code	ACK	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
ACK	Control code(ACKnowledge)	1 byte	ACK(0x06)
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(ii) Negative acknowledge response

Reply frame

Frame format

STX	Code	NAK	Error code	BCC	CR

	Explanation	Data size	Value
STX	Control code(Start of Text)	1 byte	STX (0×02)
Code	Station number of inverter	2 byte	01～32
NAK	Control code(ACKnowledge)	1 byte	ACK(0x06)
Error code	Error code Communication	2 byte	(Note11)
BCC	Block check code	2 byte	Exclusive OR of Code, Command and Data (5) Reference
CR	Control code(Carriage Return)	1 byte	CR (0×0D)

(Note 11) Error code list

Inverter doesn't reply on all code communication

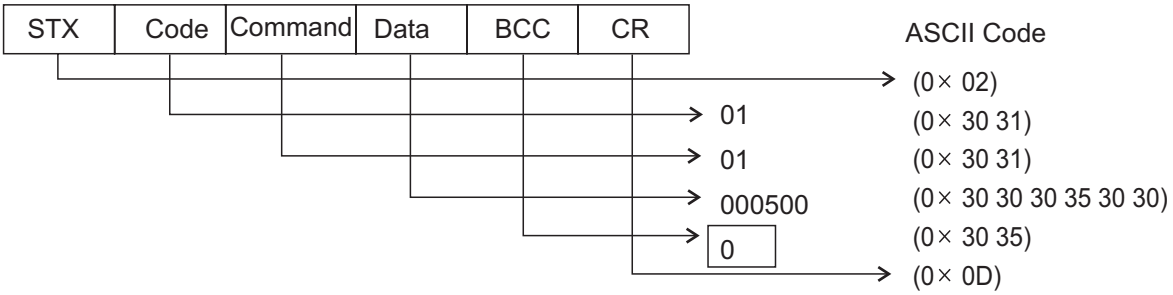
Error code	Contents
01H	Parity error
02H	Sun check error
03H	Framing error
04H	Overrun error
05H	Protocol error
06H	ASCII code error
07H	Reception buffer overrun error
08H	Reception time out error
-	-
-	-
11H	Error for abnormal command
12H	-
13H	Practice disapproval error
14H	-
15H	-
16H	Parameter abnormal error
17H	-

Chapter 4 Explanation of function

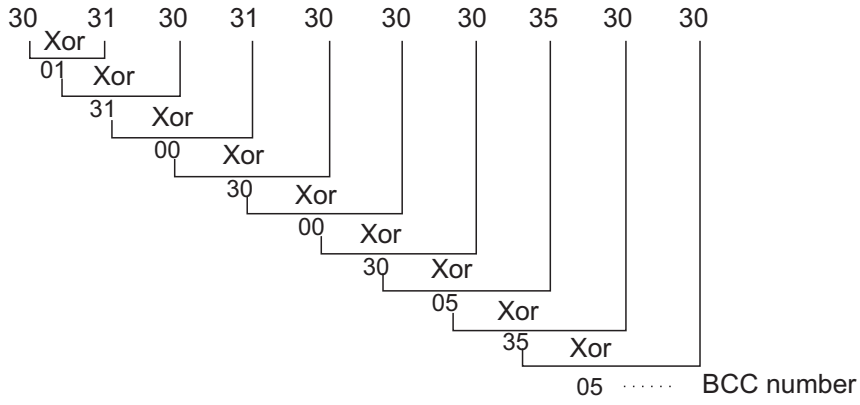
(5) About the calculation of BCC (the Block Check Code)

(Example) 5Hz is set up by using 01 command (the setting of the frequency command). (When the code of the inverter of the object is "01")

Constitution of the transmission frame



BCC is the result that transforms the Code～Data into ASCII Code and took an EXCLUSIVE OR (Xor) every 1byte. In the case of the above transmission frame, BCC calculates it as follows.



(Appendix) ASCII code transformation table

Character data	ASCII code
STX	02
ACK	06
CR	0D
NAK	15
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39

Character data	ASCII code
A	41
B	42
C	43
D	44
E	45
F	46
H	48
P	50

Chapter 4 Explanation of function

(6) Communication test mode

The communication test mode checks the communication line of RS485.

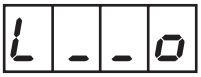
(The communication test mode procedure)

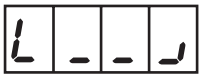
(ⅰ) Please remove the wiring of terminal unit TM2 of the control terminal unit foundation, to do the loop back check.

(ⅱ) Please set up the following with the operator of the inverter.

(ⅲ) Shut the power supply of the inverter at first and please turn on the power supply once again. The check is started.

(ⅳ) When the check ends the display is as follows.

Normal: 

Abnormal: 

(ⅴ) Please push the reset button of the digital operator or copy unit. And, the setting of C071 is returned to the setting of an original request.

Chapter 4 Explanation of function

4.4 Protection function list

4.4.1 Protection function

Name	Description		Display of digital operator	Display of remote operator /Copy unit ERR1***
Over-current protection	Motor is restricted and decelerates rapidly, excessive current is drawn through the inverter and there is a risk of damage. Current protection circuit operates and the inverter output	At constant speed	E01	OC. Drive
		On deceleration speed	E02	OC. Decel
		On acceleration speed	E03	OC. Accel
		Other	E04	Over.C
Overload protection(Note1)	When the inverter detects an overload in the motor, the internal electronic thermal overload operates and the inverter output is switched off.		E05	over. L
Braking resistor overload protection	When BRD exceeds the usage ratio of the regenerative braking resistor, the over-voltage circuit operates and the inverter output is switched off.		E06	OL. BRD
Over-voltage protection	When regenerative energy from the motor exceeds the maximum level, the over -voltage circuit operates and the inverter output is switched off.		E07	Over.V
EEPROM error (Note2)	When EEPROM in the inverter is subject to radiated noise or unusual temperature rises, the inverter output is switched off.		E08	EEPROM
Under-voltage	When the incoming voltage of inverter is low, the control circuit can 't operate correctly. The under -voltage circuit operates and the inverter output is switched off.		E09	Under.V
CT error	When an abnormality occurs to a ct (current detector) in the inverter, the inverter output is switched off.		E10	CT
CPU error	When a mistaken action causes an error to the built -in CPU, the inverter output is switched off.		E11	CPU
External trip	When a signal is given to the EXT intelligent input terminal, the inverter output is switched off. (on external trip function selsct)		E12	EXTERNAL
USP error	This is the error displayed when the inverter power is restored while still in the RUN mode. (Valid when the USP function is selected)		E13	USP
Ground fault protection	When power is turned ON, this detects ground faults between the inverter output and the motor.		E14	GND. Flt
Incoming over-voltage protection	When the incoming voltage is higher than the specification value, this detects it for 60 seconds then the over -voltage circuit operates and inverter output is switched off.		E15	OV. SRC
Temporary power loss protection	When an instantaneous power failure occurs for more than 15ms, the inverter output is switched off. Once the instantaneous power failure wait time has elapsed and the power has not been restored it is regarded as a normal power failure. However, when the operation command is still ON with restart selection the inverter will restart. So please be careful of this.		E16	Inst. P-F
Abnormal temperature	When main circuit temperature raises by stopping of cooling fan, the inverter output is switched off.		E21	OH. FIN
Gate Allay error	Communication error between CUP and gate array indicate		E23	GA
Open-phase protection	When an open - phase on the input supply occurs the inverter output is switched off.		E24	PH. Fail
IGBT error	When an instantaneous over -current is detected on the output the inverter output is switched off to protect the main devices.		E30	IGBT
Thermistor error	When the inverter detects a high resistance on the thermistor input from the motor the inverter output is switched off.		E35	TH

Chapter 4 Explanation of function

Item	Contents	Display of digital panel	Display of remote operator /Copy unit ERR1***
Abnormal brake	When inverter cannot detect switching of the brake(ON/OFF) after releasing the brake and for waiting for signal condition(b124) When the braking control selection(b120) is enable)	E 36.	BRAKE
Option 1 error 0-9	These indicate the error of option1, You can realize the details each instruction manual.	E 60. ~ E 69.	OP1 0～9
Option 2 error 0-9	These indicate the error of option2, You can realize the details each instruction manual.	E 70. ~ E 79.	OP2 0～9
During under-voltage waiting	When the incoming voltage of the inverter has dropped, the inverter output is switched off and the inverter waits.	- - - -	UV. WAIT

Note 1) After a trip occurs and 10 second pass, restart with reset operation.

Note 2) When EEPROM error E 08 occurs, confirm the setting data again.

Note 3) Protection function list of optional board.

(1) Feed-back board(N-FB)

Item	Contents	Display of digital panel	Display of remote operator ERR1***
Encoder line break	Detect the line or disconnection of the encoder line. Detect when there is an encoder failure. Detect when the specification of encoder is not line driver type. Detect when there is no Z pulse.	E60. ~ E70.	OP1-0 , OP2-0
Over speed	Detect when motor rotation speed exceeds.	E61. ~ E71.	OP1-1 , OP2-1
Positioning error	Detect when the deviation of the current position and command value becomes more than 1,000,000pules during position controlling	E62. ~ E72.	OP1-2 , OP2-2
Connection error	Detect abnormal connection between the inverter main bady and N-FB.	E69. ~ E79.	OP1-9 , OP2-9

(2) Digital-input option board(N-DG)

Item	Contents	Display of digital panel	Display of remote operator ERR1***
SJ-DG Error	Detect abnormal connection between the inverter main bady and N-DG	E60. ~ E70.	OP1-0 , OP2-0

(3) DeviceNet option board (N-DN)

Item	Contents	Display of digital panel	Display of remote operator ERR1***
Device-Net communication error	This error is displayed, disconnection occurs when bus off or timeout is occurred, while the inverter is operating with Device Net. (Trip is caused by P045 and P048 setting)	E60. ~ E70.	OP1-0 , OP2-0
Duplicate MACID	This error indicates that component have the same MACID, which exist on the same network.	E61. ~ E71.	OP1-1 , OP2-1
External trip	This error is displayed, when fault / Trip is set to 1 toward control supervisor object data : Instance 1, Attribute 17.	E62. ~ E72.	OP1-2 , OP2-2
Inverter communication error	This error is displayed, when communication timeout occurs between the inverter and the option board.	E69. ~ E79.	OP1-9 , OP2-9

Chapter 4 Explanation of function

Note 4) If the inverter doesn't run normally or the inverter trips, check the dip switch and/or rotary switch setting on optional board

(1) Feed-back board (N-FB)

DIP-SWITCH	SWITCH NO.	Contents	
SWENC	1	ON	Detection of disconnect A or B signal is valid
		OFF	Detection of disconnect A or B signal is invalid.
	2	ON	Detection of disconnect Z signal is valid
		OFF	Detection of disconnect Z signal is valid
SWR	1	OFF	Terminal resistance is provided between SAP and SAN (150 ohm)
		ON	No terminal resistance is provided between SAP and SAN
	2	OFF	Terminal resistance is provided between SBP and SBN (150 ohm)
		ON	No terminal resistance is provided between SBP and SBN

(2) Digital-input option board (N-DG)

Dip Switch		Rotary Switch	Setting frequency				Acceleration and deceleration time setting			Torque limit setting	Position setting
TYPE		CODE	Setting resolution								
Switch No.		Setting code	0.01Hz	0.1Hz	1Hz	Rate	0.01sec	0.1sec	1sec	1%	1Pulse
1	2										
BIN (Binary input at OFF) / BCD (BCD input at ON)	PAC (One time input mode at OFF)	0	○								
		1		○							
		2			○						
		3				○					
		4								○	
		5									
		6									○
	DIV (Dividing input mode at ON)	0	○				○				
		1						○			
		2							○		
		3		○			○				
		4						○			
		5							○	○	○
		6			○		○				
		7						○			
		8							○		
		9				○	○				
		A						○			
		B							○		

Chapter 4 Explanation of function

(3) Device Net option board(N-DN)

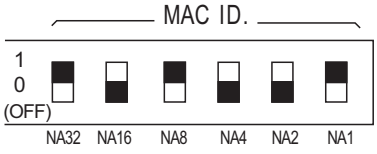
The table below is the setting method of Baud rate (Front view of the option board)

(↓,↑ indicate direction for switch of Dip switch)

	125kbps	250kbps	500kbps
Dip switch Setting			

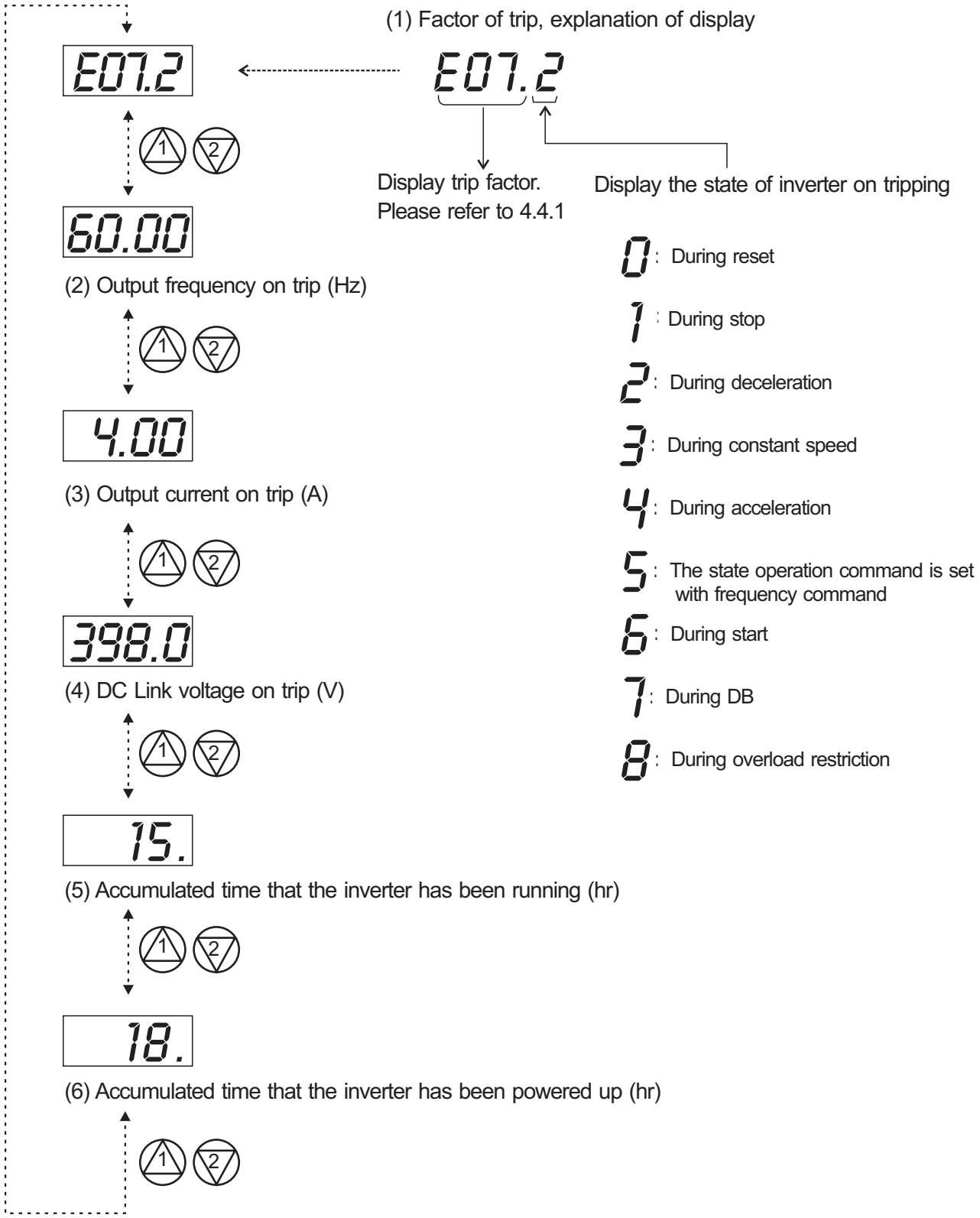
(Note) Do not switch on DR1 and DR0 at the same time.

The table below is the setting method of MAC ID (Front view of the option board)

MAC ID.	Dip switch setting
	Figure left describes the direction of Dip switches. See below. Bottom : 0 Upper : 1 Bit increases from right to left switches. Therefore, figure left becomes formula below. $\overline{1}\cdot 2^5+\overline{0}\cdot 2^4+\overline{1}\cdot 2^3+\overline{0}\cdot 2^2+\overline{0}\cdot 2^1+\overline{1}\cdot 2^0$= 29(Hex) = 41(dec) $\overline{NA32}\ \overline{NA16}\ \overline{NA8}\ \overline{NA4}\ \overline{NA2}\ \overline{NA1}$

Chapter 4 Explanation of function

4.4.2 Trip monitor display


(1) Factor of trip, explanation of display
E07.2
E07.2
Display trip factor.
Please refer to 4.4.1
Display the state of inverter on tripping
0 : During reset
1 : During stop
2 : During deceleration
3 : During constant speed
4 : During acceleration
5 : The state operation command is set with frequency command
6 : During start
7 : During DB
8 : During overload restriction
60.00
(2) Output frequency on trip (Hz)
4.00
(3) Output current on trip (A)
398.0
(4) DC Link voltage on trip (V)
15.
(5) Accumulated time that the inverter has been running (hr)
18.
(6) Accumulated time that the inverter has been powered up (hr)

Chapter 4 Explanation of function

4.4.3 Warning Monitor display

Relation code

d090 : Warning Monitor

Warning message will appear when the data set is contradicting to others. Program lamp (PRG) turns ON during the warning (until the data is changed). Below is the description of the warning.

Warning	Codes	<,>	Basic code
001/ 201	Frequency upper limiter A061/261	>	Maximum frequency A004/A204/A304
002/ 202	Frequency lower limiter A062/A262	>	
004/ 204/ 304	Base frequency A003/A203/A303	>	
005/ 205/ 305	Output frequency F001, Multi stage speed 0 A020/A220/A320	>	
006/ 206/ 306	Multi stage speed1～15 A021～A035	>	
012/ 212	Frequency upper limiter A062/262	>	Frequency upper limiter A061/A261
015/ 215	Output frequency F001, Multi stage speed 0 A020/A220	>	
016/ 216	Multi stage speed1～15 A021～A035	>	
021/ 221	Frequency upper limiter A061/261	<	Frequency lower limiter A062/A262
025/ 225	Output frequency F001, Multi stage speed 0 A020/A220	<	
031/ 231	Frequency upper limiter A061/261	<	Starting frequency b082
032/ 232	Frequency lower limiter A062/A262	<	
035/ 235/ 335	Output frequency F001, Multi stage speed 0 A020/A220/A320	<	
036	Multi stage speed1～15 A021～A035	<	
037	Jogging frequency A038	<	
085/ 285/ 385	Output frequency F001, Multi stage speed 0 A020/A220/320	< >	Jump frequency 1/2/3 ±Jump width A063±A064 A065±A066 A067±A068 (Note 1)
086	Multi stage speed1～15 A021～A035	< >	
091/ 291	Frequency upper limiter A061/261	>	Free v/f frequency 7 b 112
092/ 292	Frequency lower limiter A062/A262	>	
095/ 295	Output frequency F001, Multi stage speed 0 A020/A220	>	
096	Multi stage speed1～15 A021～A035	>	
110	Free v/f frequency 1～6 b100, b102, b104,b106, b108, b110	>	
	Free v/f frequency 2～6 b102, b104, b106, b108, b110	<	Free v/f frequency 1 b100
	Free v/f frequency 1 1 b100	>	Free v/f frequency 2 b102
	Free v/f frequency 3～6 b104, b106 b108, b110	<	
	Free v/f frequency 1, 2 b100, b102	>	Free v/f frequency 3 b104
	Free v/f frequency 4～6 b106, b108, b110	<	
	Free v/f frequency 1～3 b100, b102, b104	>	Free v/f frequency 4 b106
	Free v/f frequency 5, 6 b108, b110	<	
	Free v/f frequency 1～4 b100, b102, b104, b106	>	Free v/f frequency 5 b108
	Free v/f frequency 6 b110	<	
	Free v/f frequency 1～5 b100, b102, b104, b106, b108	>	Free v/f frequency 6 b110
120	Free v/f frequency 2, 3 b017, b019	<	Free electronic thermal frequency 1 b015
	Free v/f frequency 1 b015	>	Free electronic thermal frequency 2 b017
	Free v/f frequency 3 b019	<	
	Free v/f frequency 1, 2 b015, b017	>	Free electronic thermal frequency 3 b019

Warning is cleared when the setting fulfils the above condition.
Data will be changed automatically to the basic code.

(Nete 1) The jump frequency will be automatically re-written to the lowest jump frequency (= Jump frequency - jump width)

Chapter 5 Maintenance, Inspection

WARNING

- After a lapse of more than 10 minutes after tuning off the input power supply, perform the maintenance and inspection.
  Otherwise, there is a danger of electric shock.

- Make sure that only qualified persons will perform maintenance, inspection and part replacement.
  (Before starting the work, remove metallic objects from your person wristwatch, bracelet, etc.)
  (Be sure to use tools protected with insulation)
  Otherwise, there is a danger of electric shock and/or injury.

5.1 Precautions for Maintenance/Inspection

5.1.1 Daily inspection

Every day before operation check the following:

[1] Does the motor operate according to the settings?
[2] Is there any trouble with the surroundings of the installation?
[3] Is there any trouble with the cooling or ventilation system?
[4] Is there any abnormal vibration or sound?
[5] Are their any signs of over-current or discoloration?
[6] Is their any unusual odor present?

Check the input voltage to the inverter by using a meter during running

[1] Is the supply voltage constant?
[2] Are all the phases of the supply balanced?

5.1.2 Cleaning

Make sure that the inverter is not dirty when operating.
Wipe clean with a soft cloth and synthetic detergent.

(Note) Don't use solvents containing any of the following, acetone, benzene, toluene, alcohol etc. As they can cause melting of the inverter surface, peeling of paint.
Never clean the display part of the digital operator with detergent of alcohol.

5.1.3 Regular inspection

Inspections should be regularly carried out on the parts that can't be inspected while the inverter is running.

[1] Is there any trouble with the cooling system? ---- Cleaning of air filter etc.
[2] Check that all screw terminals and fixings are tight as they may loosen due to vibration or temperature change etc.
[3] Is there any corroison, damage to insulators?
[4] Measurement of insulation resistance.
[5] Check of cooling fan, smoothing capacitor, relay and exchange if necessary.

Chapter 5 Maintenance, Inspection

5.2 Daily inspection and regular inspection

Inspection Parts	Inspection item	Inspection item	Inspectioncycle			Inspection methods	Decision standard	Meter
			Daily	Year 1	Year 2			
Whole	Surroundings	Check temperature of surrounding, humidity, dust.	○			Refer to 2.1 Installing.	Temperature range is between-10 and 40 degrees. No dew present and humidity is below 90%	Thermometer, hygrometer, recorder
	Whole equipment	Is there abnormal vibration, abnormal sound?	○			By watching, hearing.	No trouble	
	Power voltage	Is main circuit voltage normal?	○			Measurement of inverter terminal R,S,T phase voltage	Within alternating voltage allowable change.	Tester,digital multi-meter
Main circuit	Whole	(1) Megger check Between circuit terminal and earth terminal (2) Are all screws terminals tight? (3) Is there any sign of over - voltage? (4) cleaning		○ ○ ○	○	(1) After you remove connector J61 from inside the inverter Take out the wiring of input/output of inverter main circuit terminal and control terminal, measure between parts shortened shortened terminal R,S,T,U,V,W,P,PD,N,RB and earth terminal with megger (2) Incremental clamping. (3) Watch	(1) To be over 5M ohm. (2) (3) No abnormality.	DC500V class megger
	Connection conductor/ electric line	(1) Is there warp in conductor? (2) Is there any damage of coating of wires?		○ ○		(1) (2) By watching	(1) (2) No abnormality	
	Terminals	Is there any damage?		○		By watching.	No abnormality.	
	Inverter parts converter parts	Resistance check between each terminal.			○	Take out connect of inverter, measure terminal between R,S,T and P,N between U,V,W and P,N with tester x 1 ohm range.	Refer to check method of 5.5 inverter, converter parts.	Analog form tester
	Smoothing capacitor	(1) Is there any liquid? (2) Does relief valve come out? Is there any swell? (3) Measure of allowable static-electricity.	○ ○		 ○	(1), (2) By watching. (3) Measure with capacity measure	(1), (2) No abnormality (3) Over 80% of rated capacity.	Capacity meter
	Relay	(1) Is there abnormal sound in operation? (2) Is there damage to the contacts?		○ ○		(1) By hearing (2) By watching	(1) No abnormality (2) No abnormality	
	Resistor	(1) Is there any crack, discoloration of resistance insulator. (2) Confirm existance of breaking of wire.		○ ○		(1) By watching cementing resistance. Curl type resistance. Take out connection to other side, measure it with tester.	(1) No abnormality Error to be within 10% of Display resistance.	Tester Digital multimeter
Control circuit protection circuit	Operation check	(1) Confirm balance of each output phase voltage with inverter single operation. (2) Operate sequence protection moving test. And no abnormality.		○ ○		(1) Measure inverter output terminal U,V,W phase voltage. (2) Short or open protection circuit output of inverter.	(1) Phase voltage balance 200V/400V class is within 4V/8V. (2) On sequence, to operate abnormality.	Digital multimeter rectification type voltmeter
Cooling system	Cooling fan	(1) Is there abnormal vibration, abnormal sound? (2) Is there loosening of connecting parts?	○	 ○		(1) Revolve by hands in the state of tone-on idle. (2) By watching.	(1) Revolving smooth. (2) No abnormality.	
Display	Display	(1) Is the LED lamp illuminated? (2) Cleaning.	○	 ○		(1) Lamp indicates lamp on operator. (2) Cleaning with cloth.	(1) Confirm light.	
	Meter	Is direction value Normal?	○	○		Confirm indication value of board meter.	Satisfy normal value, control value.	Voltage meter, current meter
Motor	Whole	(1) Is there abnormal signal, abnormal sound? (2) Is there any abnormal odour?	○ ○			(1) By hearing, feeling, watching. (2) Abnormal odour from overheat, damage etc. confirmation.	(1)(2) No abnormality.	
	Inslated resistance	(1) Megger check (terminal collection earth terminal)			○	Remove connection to U,V and W and disconnect motor wiring.	(1) To be over 5M ohm.	DC500V Megger

(Note) Lifetime of the capacitors depends on the ambient temperature.

Chapter 5 Maintenance, Inspection

5.3 Megger test

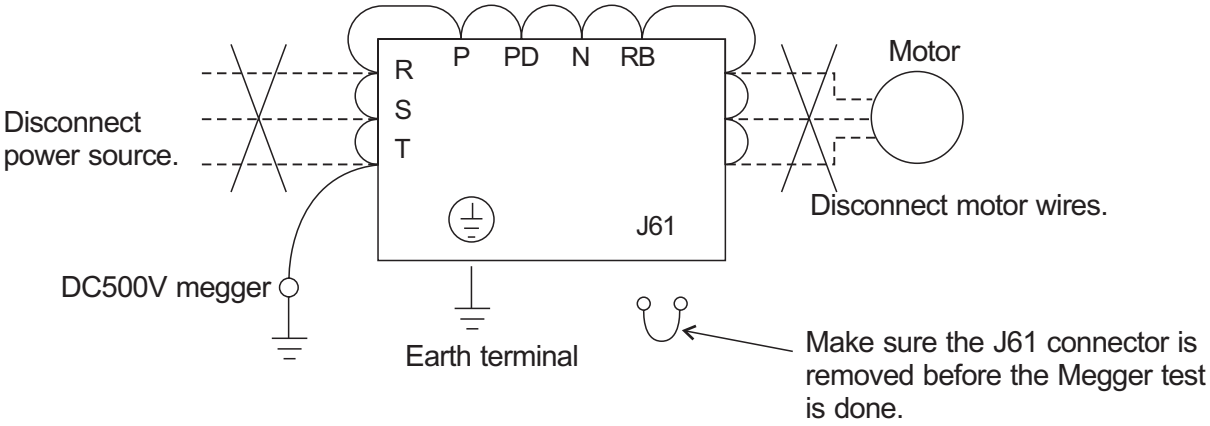
When executing a megger test on the inverter remover all wires to R, S, T, PD, N, RB, U, V and W.

Do not use a megger or buzzer on the control circuit only use a digital multi-meter.

(Megger Voltage 500V DC)

Execute megger test is complete, reconnect the J61 connector has been removed. Short terminals of R, S, T, PD, P, N, RB, U, V, and W.

After the megger test is complete, reconnect the J16 connector as before.



5.4 Withstand Voltage test

Never perform a withstand voltage test on the inverter.

The inverter main circuit uses semiconductors. Semiconductors can deteriorate when a withstand voltage test is performed.

Chapter 5 Maintenance, Inspection

5.5 The method to check Inverter, converter part

A test is possible to check quality.

(Preparation)

[1] Take out the power lines (R, S and T0 connected to the inverter, the motor connection lines(U, V and W) and the regenerative control resistance (P and RB)

[2] Prepare tester. (Using range of 1 ohm resistance measure range)

(How to check)

It is possible to check the quality of the charging state of the terminals R, S, T, U, V, W RB, P and N of the inverter and the pole of the rester by measuring the charging state.

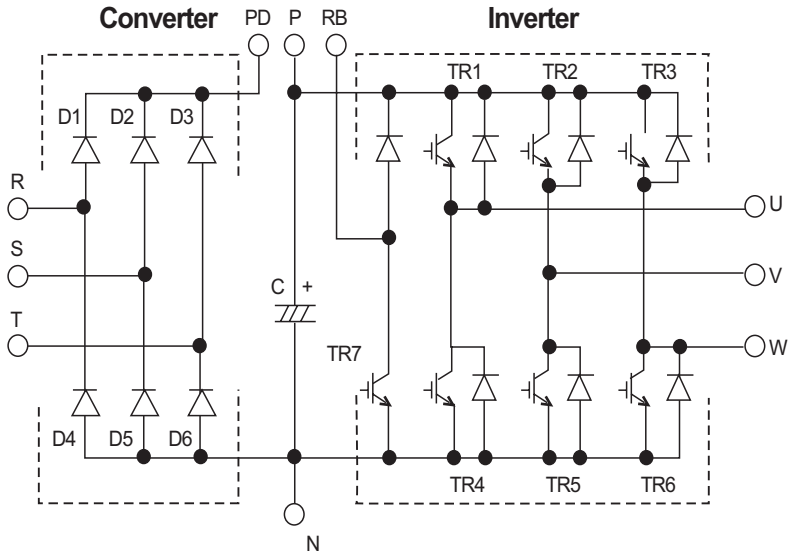
(Note 1) Before you measure the voltage between P and N with DC current range, confirm that the smoothing capacitor is discharged fully, execute checks.

(Note 2) Almost infinite value is indicated on no conducting.

With the effect of the smoothing capacitor, the inverter conducts instantly and an infinite value isn't indicated. Ohm-number 10 ohms is indicated on conducting.

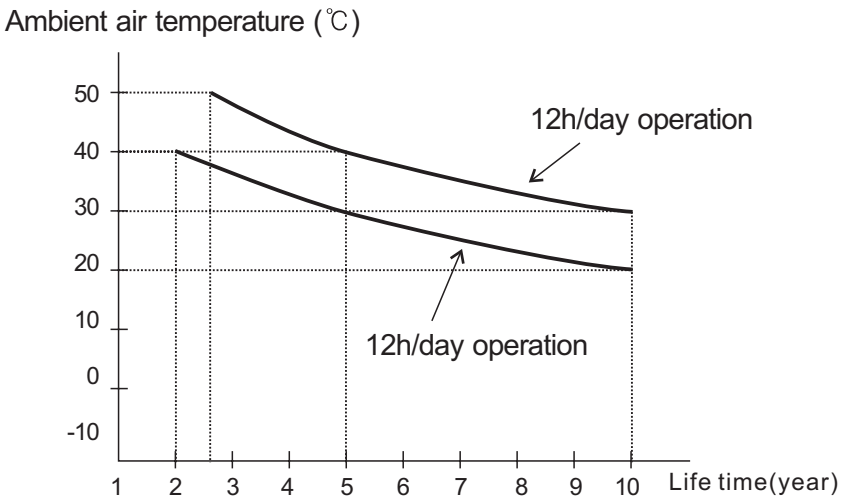
The values indicated will not be exactly the same for each terminal, however they will be very close together. If there is a significant difference a problem may exist.

		Pole of tester ⊕ Red	Pole of tester ⊖(Black)	Measure value
Converter	D1	R	PD	No-conduct
		PD	R	Conduct
	D2	S	PD	No-conduct
		PD	S	Conduct
	D3	T	PD	No-conduct
		PD	T	Conduct
	D4	R	N	Conduct
		N	R	No-conduct
	D5	S	N	Conduct
		N	S	No-conduct
	D6	T	N	Conduct
		N	T	No-conduct
Inverter	TR1	U	P	No-conduct
		P	U	Conduct
	TR2	V	P	No-conduct
		P	V	Conduct
	TR3	W	P	No-conduct
		P	W	Conduct
	TR4	U	N	Conduct
		N	U	No-conduct
	TR5	V	N	Conduct
		N	V	No-conduct
	TR6	W	N	Conduct
		N	W	No-conduct
BR part	TR7	RB	P	No-conduct
		P	RB	Conduct
		RB	N	No-conduct
		N	RB	No-conduct



Chapter 5 Maintenance, Inspection

5.6 Capacitor Life Curve



(Note 1)

Ambient air temperature means the surrounding temperature of the inverter. In case the inverter is installed in a cabinet, ambient air temperature is the temperature of the internal air of the cabinet.

(Note 2)

DC bus capacitors are recommended to be replaced every 5 years. And if the inverter is used in a worse condition, this recommended replacing period is reduced.

Chapter 6 Specification

6.1 Standard specification list

(1) 200V class

Inverter Model		N300-055LF	N300-075LF	N300-110LF	N300-150LF	N300-185LF	N300-220LF	N300-300LF	N300-370LF	N300-450LF	N300-550LF
Max. Applicadie Motor 4P (kW)		5.5	7.5	11	15	18.5	22	30	37	45	55
Rated input Altemating (kVA)	200V	8.3	11.0	15.9	22.1	26.3	32.9	41.9	50.2	63.0	76.2
	240V	9.9	13.3	19.1	26.6	31.5	39.4	50.2	60.2	75.8	91.4
Rated input altem-ating voltage		Three-phase 200-240V(±10%) 50/60Hz									
Rated output voltage		Three-phase 200-240V(This corresponds to receving voltage.)									
Rated output current (A)		24	32	46	64	76	95	121	145	182	220
Stating	Regenerative control	BRD circuit built-in			Regenerative unit is required						
	Minimum Resistance To be connected (OHM)	17	17	17	—	—	—	—	—	—	—

(2) 400V class

Inverter Model		N300-055HF	N300-075HF	N300-110HF	N300-150HF	N300-185HF	N300-220HF	N300-300HF	N300-370HF	N300-450HF	N300-550HF	N300-750HF	N300-900HF	N300-1100HF	N300-1320HF
Max. Applicadie Motor 4P (kW)		5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132
Rated input Altemating (kVA)	200V	8.3	11.0	15.9	22.1	26.3	32.9	41.9	50.2	63.0	76.2	103.2	121.9	150.3	180.1
	240V	9.9	13.3	19.1	26.6	31.5	39.4	50.2	60.2	75.8	91.4	123.8	146.3	180.4	216.1
Rated input altem-ating voltage		Three-phase 380-480V(±10%) 50/60Hz													
Rated output voltage		Three-phase 380-480V(This corresponds to receving voltage.)													
Rated output current (A)		12	16	23	32	38	48	58	75	90	110	149	179	217	260
Stating	Regenerative control	BRD circuit built-in			Regenerative unit is required										
	Minimum Resistance To be connected (OHM)	70	50	50	—	—	—	—	—	—	—	—	—	—	—

Chapter 6 Specification

(3) Common specification for 200V/400V class

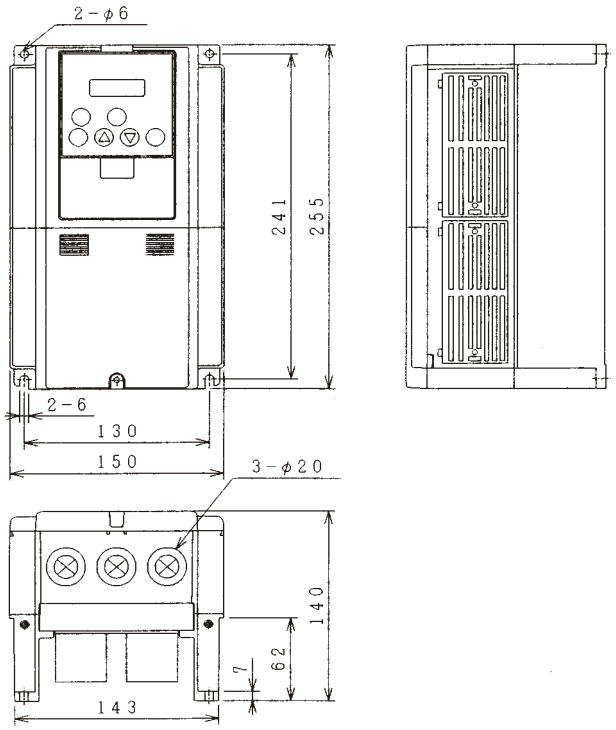
Inverter Model			N300-055LF/HF	N300-075LF/HF	N300-110LF/HF	N300-150LF/HF	N300-185LF/HF	N300-220LF/HF	N300-300LF/HF	N300-370LF/HF	N300-450LF/HF	N300-550LF/HF	N300-750HF	N300-900HF	N300-1100HF	N300-1320HF
Enclosures			IP20(NEMA1)													
Control system			Sine-wave modulation PWM system													
Output frequency range			0.1～400Hz													
Frequency accuracy			Digital command ±0.01% for Max. frequency, analog frequency ±0.2% (25±10℃)													
Frequency resolving power			Digital setting : 0.01Hz, Analog setting : Max. frequency/4000													
Voltage/frequency characteristic			V/f option variable, V/f control, (constant torque, reduced torque), sensor-less vector control(base frequency 30～40Hz)													
Speed fluctuation			±0.5% (Sensor-less vector control)													
Overload current rate			150% for seconds, 200% for 0.5 second										150% for 60 seconds, 180% for 0.5second			
Stating torque			200% / 0.5Hz (sensor-less vector control)										180% / 0.5Hz(sensor-less vector control)			
			150% / 0Hz area torque(0Hz sensor-less vector control, At the time of 1 frame under motor connection)										130%/0Hz area torque			
DC Braking			on starting and decelerating by stop command, inverter operates under operation setting frequency.Or inverter operates with external input (Breaking power, time, frequency can be set.)													
Input	Frequency	Operator	Setting by ⚠ key.													
		Volume	DC0～10V, -10～+10V (input impedance 10Kohn), 4～20mA (input impedance 100ohm)													
		Extend signal	Setting with RS485 communication													
	Run/ Stop	Operator	Run/Stop													
		Volume	Forward Run/Stop(1a connect),reverse command is impossible on assigning of terminal(selection of 1a, 1b is possible),input of 3 wires is possible.													
		Extend signal	Setting with RS485 communication													
	Intelligent input terminal		Use by selecting terminals from Reverse command(RV), multi-speed 1-4(CF1-CF4), jogging(JG), external dc braking(DB), 2nd control(SET), 2nd acceleration(2CH), free-run stop(FRS), external trip(EXT), USP function(USP), commercial change(CS), software lock(SFT), analog input voltage/current/select(AT), 3rd control(SET3), reset inverter(RS), 3 wire run(STA), 3wire keep (STP), 3wire direction selection(F/R), PID selection valid/invalid(PID), PID integrating reset(PIDC), control gain change(CAS), remote control, up function(UP), remote control down function(DWN), remote control data clear(UDC), compulsion operation(OPE),multi-speed bit 1-7(SF1-SF7), overload ristriction change(OLR), torque limit exist or no(TL), torque limit change1(TRQ1), torque limit change12(TRQ2), P/PI change(P/PI), brake confirmation (BOK), orientration(ORT),LAD cancel(LAC), position deviation dear(PCLR), 90 degrees the phase difference permission(STAT), permissive input signal for FW/RV(ROK), no assign (NO)													
	Thermistor input terminal		1 terminal													
Output	Intelligent output terminal		Signal during rus(RUN), Frequency arrival type 1 signal(FA1), Frequency arrival type 2 signal(FA2), Overload advance notice signal(OL), Output deviation for PID control(OD), Alarm signal(AL), Arrival signal for only setting frequency(FA3), Over torque(OTQ), Instantaneous stop signal(IP), Under voltage signal(UV), Torque limit (TRQ), RUN time over(RNT), ON time over(ONT), Thermal caution(THM), Brake opning(BRK), Brake error(BER), Zero speed detect signal(ZS), Speed deviation excessive(DSE), Positioning completion(POK), Arrival signal for over setting frequency2(FA4), Arrival signal for only setting frequency2(FA5), Overload advance notice signal2(OL2), Alarm cord 0-3(AC0-AC3)													
	Intelligent monitor output terminal		Analog voltage output, analog current output, pulse line output													
Display monitor			Output frequency, output current, frequency conversion value, trip history, input output terminal state, input electric power, output voltage, motor torque													
Other function			V/F free setting(7points), Upper/lower frequency limitter, Frequency jump, curve adjustable speed, manual torque boost level/Braking point, Analog meter adjustment, Starting frequency, Carrier frequency adjustment, Electronic thermal free setting, External start/end (frequency/tate), Analog input selection, Trip retry, Reduced voltage start, Overload restriction, energy-saving operation, Restarting after an instantaneous power failure, Various kinds signal output, Initialization value setting, Automatic deceleration at the time of the power supply block, AVR function, Fuzzy, Autotuning(Online/Offline), High torque multi running(Sensor-less vector control with 1 inverters of 2 motors)													
Carrier frequency range			0.5～15kHz													
Protection function			Over-current, over-voltage, under-voltage, electronic thermal lecvel, abnormal trouble, ground fault current on starting, instantaneous stop, USP error, open-phase error, control resistoroverload, CT error, external trip, communication error.													
Usage surrounding	Frequency temperature/Preservation temperature/humidty		-10 ～ 50℃/ -20 ～ 65℃/ 20 ～ 90% RH(installed with no dew conensation)													
	Vibration		5.9m/s ^{2} (0.6G), 10～55Hz										2.94m/s ^{2} (0.3G), 10～55Hz			
	Using place		Under 1000m above sea level, indoors (Installed away from corrosive gasses dust)													
Paint color			Grey(Munsell 8.5 YR 6.2 / 0.2)													
Option	Option		Vector control with sensor													
	Digital input option		4 column BCD, 16bit binary													
Other options			Operator with copy function, cable for operator, braking resistor, regenerative control unit, altemating reactor, D.C. reactor, EMC Mains filter, higher harmonic control unit, LCR filter, applied control installation													
Schematic mass (kg)		200V class	3.5	5	5	12	12	12	20	30	30	50	-	-	-	-
		400V class	3.5	5	5	12	12	12	20	30	30	30	60	60	80	80

Chapter 6 Specification

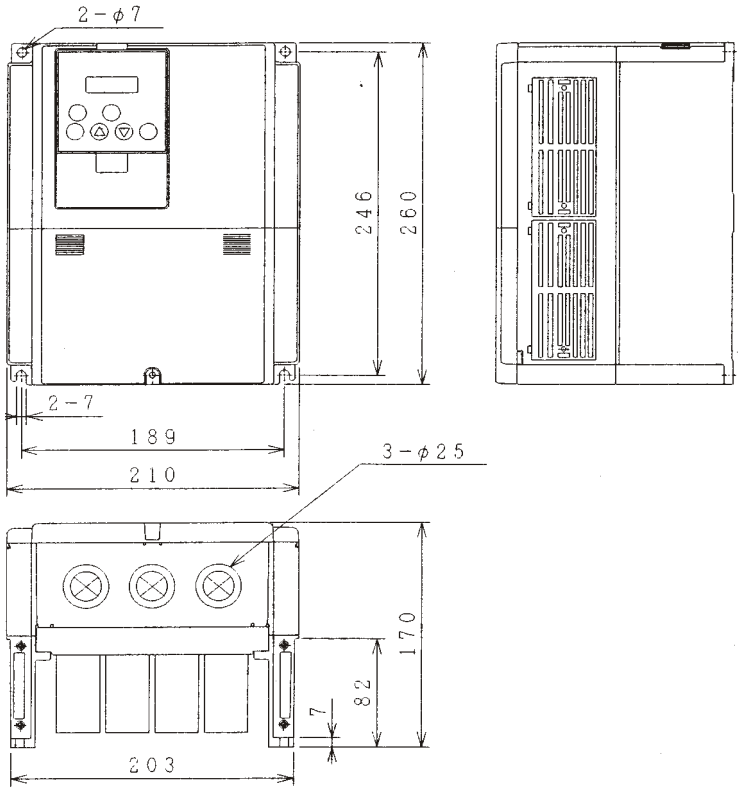
6.2 Dimension

N300-055LF

N300-055HF

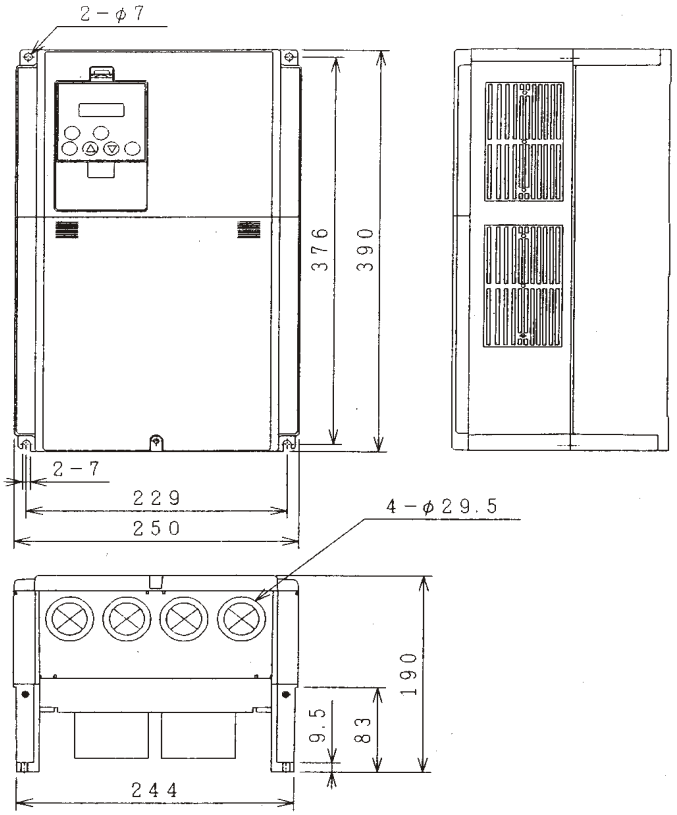


N300-075, 110LF/HF

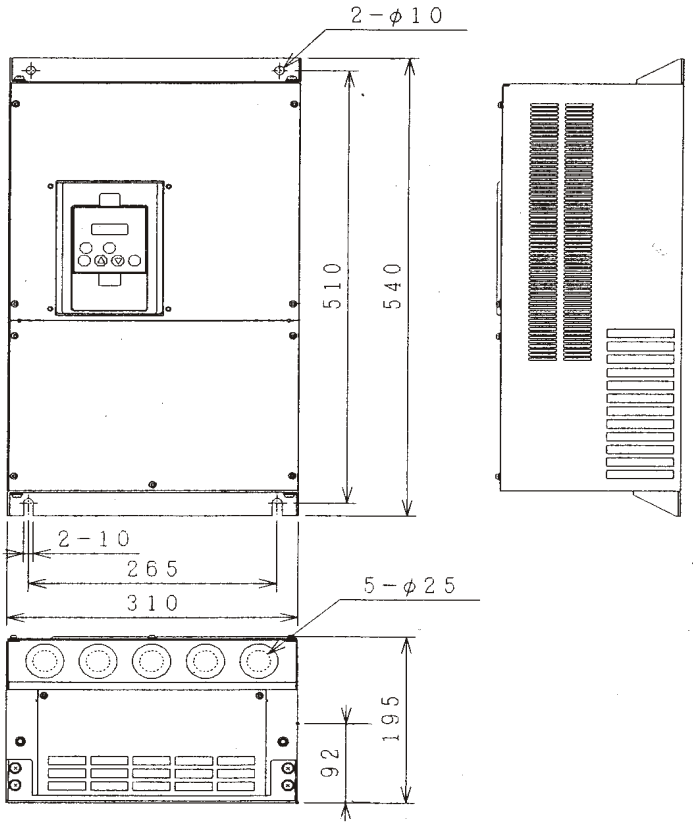


Chapter 6 Specification

N300-150, 220LF/HF



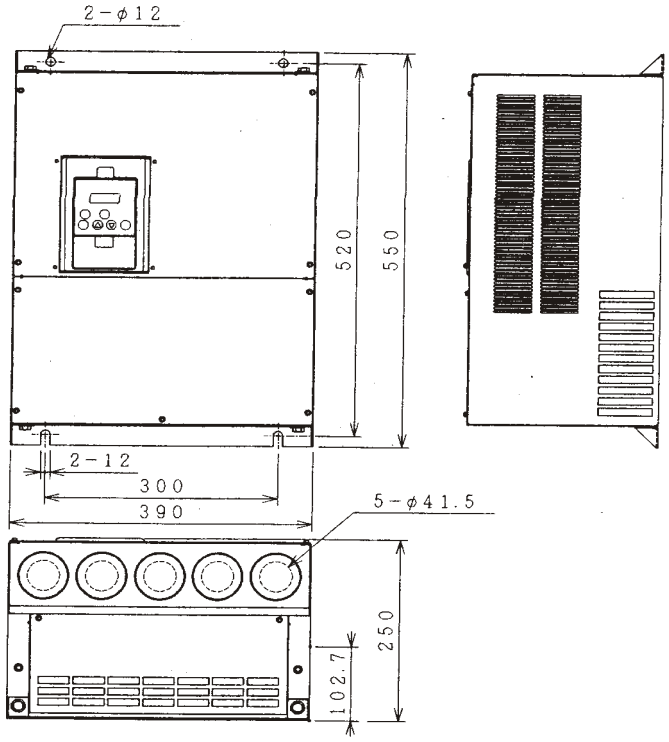
N300-300LF/HF



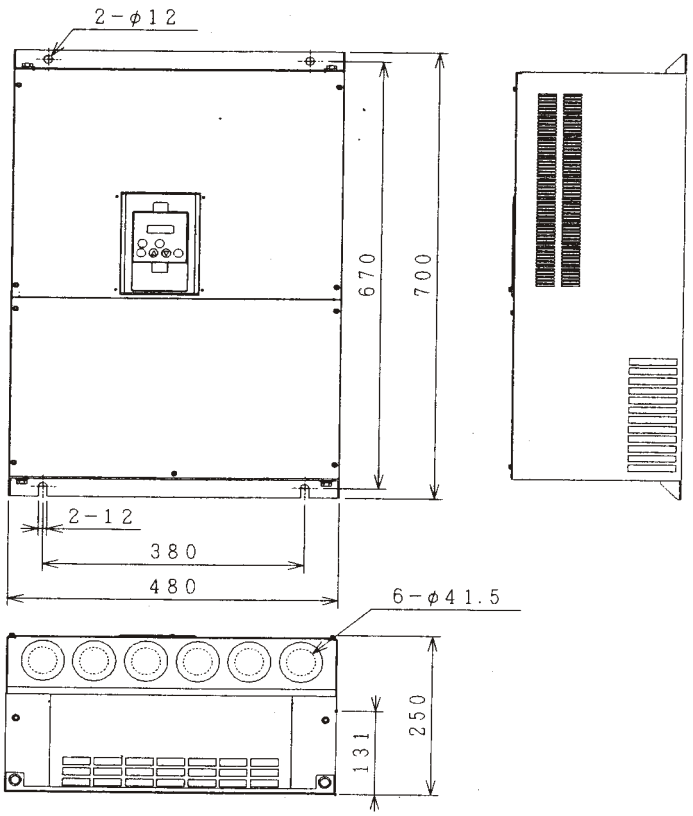
Chapter 6 Specification

N300-370, 450LF/HF

N300-550HF

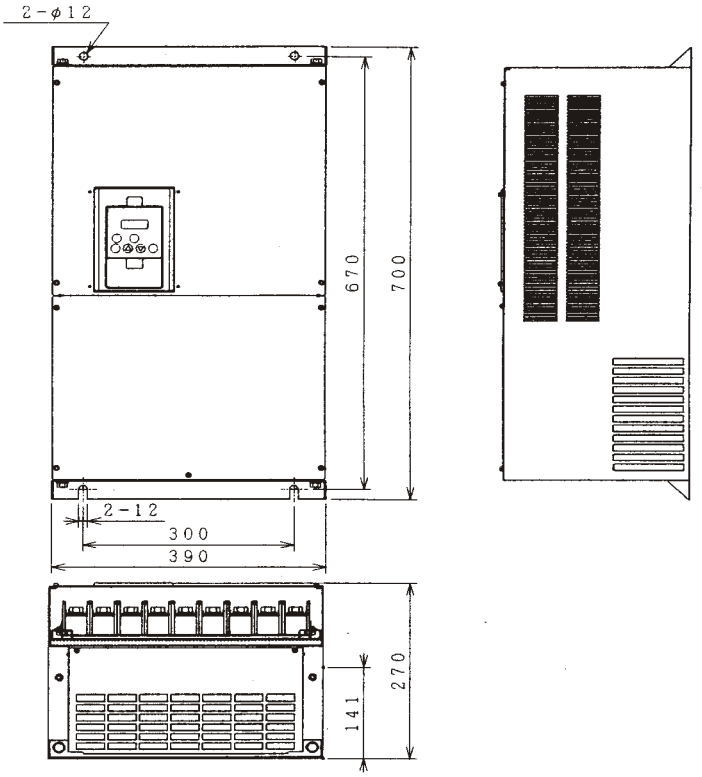


N300-550LF



Chapter 6 Specification

N300-750, 900HF



N300-1100HF, 1320HF